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Missouri Electric Works (MEW)
Expanded Ecological Risk
Screening Evaluation
Cape Girardeau, Missouri

Prepared for

The MEW Site Trust Fund Donors

Prepared by

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ENVIRON

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ACRONYMS

ACOE	United States Army Corps of Engineers
ARCS	Assessment and Remediation of Contaminated Sediment
AUF	area use factor
BEHP	Bis(2-ethylhexyl)phthalate
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BW	body weight
CBR	critical body residue
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
ENVIRON	ENVIRON International Corporation
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ER-M	Effects Range—Median
ESL	ecological screening level
HQ	hazard quotient
kg	kilogram
kg/day	kilograms per day
Komex	Komex H_2O Science
LC50	concentration lethal to 50 percent of organisms
LCV	lowest chronic value
LOAEL	lowest observed adverse effects level

MDNR	Missouri Department of Natural Resources
MDOC	Missouri Department of Conservation
MEK	2-Butanone
MEW	Missouri Electric Works
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
NAWQC	National Ambient Water Quality Criteria
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effects level
ORNL	Oak Ridge National Laboratory
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PEC	Probably Effects Concentration
PEL	Probable Effects Level
PRG	preliminary remediation goal
RI	Remedial Investigation
ROI	receptor of interest
SESL	SLERA ecological screening level
SLERA	Screening Level Ecological Risk Assessment
SMDP	scientific management decision points
SOP	standard operating procedure
SVOCs	semi-volatile organic compounds
TDI	total daily intake
TRV	Toxicity Reference Value
µg/kg	micrograms per kilogram

USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

The Missouri Electric Works (MEW) property ("MEW Property") covers approximately 6.4 acres of land in a primarily commercial/industrial area of Cape Girardeau, Missouri. Between 1953 and 1992, transformers, electric motors, and electrical equipment controls were sold, serviced, and remanufactured at the MEW Property. Commercial operations at the MEW facility ceased in 1992.

Previous studies conducted on behalf of the Missouri Department of Natural Resources (MDNR) and the United States Environmental Protection Agency (USEPA) Region VII detected Aroclor 1260 (a mixture of polychlorinated biphenyls or PCBs), as well as other chemicals, on the MEW Property and adjacent areas. The presence of these chemicals at the MEW Property is believed to be associated with historical operations, including handling and storage of PCB-containing transformer fluids.

Remediation activities to address affected soil at the MEW Property were conducted in 1999 and 2000. The affected soil was excavated and treated by thermal desorption. Soil remediation was completed in September 2000 and has effectively eliminated transport of PCBs from soils at the MEW Property. However, historical overland transport pre-dating the soil remediation may have resulted in the presence of PCBs in sediment, soil, and surface water in a downgradient Army Corps of Engineers (ACOE) channel, retention pond, drainage ditch, and wet meadow (collectively referred to as the Off-Property Area).

This report presents an expanded ecological risk screening evaluation for the Off-Property Area. Consistent with USEPA guidance, it includes a Screening Level Ecological Risk Assessment (SLERA) and additional information relevant to a refined risk evaluation (i.e., the preliminary step of a Baseline Ecological Risk Assessment, or BERA). Initially, maximum detected concentrations in sediment, surface soil, and surface water were compared to conservative screening benchmarks. Chemicals not eliminated following the initial tier of screening were evaluated in greater detail, based on additional site-specific and chemical-specific information.

Aroclor 1260 in fish tissue, sediment, and surface soil was the only chemical of potential ecological concern (COPEC) identified as warranting further evaluation to upper trophic level wildlife. The potential risks posed by PCBs to fish and wildlife receptors (i.e., belted kingfishers, great blue herons, red-tailed hawks, and mink) were evaluated using conservative assumptions.

Based on this evaluation, it is concluded that conditions in the area adjacent to the MEW Property do not pose a significant ecological risk. Key findings include:

- The results of sediment, surface soil, surface water, benthic macroinvertebrate, and fish tissue sampling do not indicate that historical releases from the MEW Property are adversely affecting ecological populations. Refined analyses of exposure and effects yielded Hazard Quotient (HQ) values that were consistently less than one.
- The Missouri Department of Conservation (MDOC) has not identified records of any species or habitats with either Federal or State restrictions within a one-mile radius of the MEW Property.
- The entire area in the immediate vicinity of the MEW Property, including the wetland area that may have been affected by historical MEW operations, is zoned for industrial land use.
- The wetland and drainage system south of Wilson Road has been and continues to be disturbed by filling, mowing, and the removal of trees and other vegetation to develop the property for commercial and industrial use.

Thus, no further action is warranted to address ecological exposures in the Off-Property Area.

1.0 INTRODUCTION

1.1 Background and Objectives

On behalf of the Missouri Electric Works (MEW) Site Trust Fund Donors, ENVIRON International Corporation (ENVIRON) prepared this expanded ecological risk screening evaluation for the Off-Property Area adjacent to the MEW Site (or "Site"), located in Cape Girardeau, Missouri. This work was conducted in conjunction with Komex H_2O Science (Komex). This report includes a Screening Level Ecological Risk Assessment (SLERA), and additional information relevant to a refined risk evaluation (i.e., the preliminary step of a Baseline Ecological Risk Assessment [BERA]). Consistent with United States Environmental Protection Agency (USEPA) (1997, 1998, 1999, 2000, 2001a, 2001b) guidance, the overall objectives of this expanded ecological risk screening evaluation are to determine whether chemicals at the Off-Property Areas adjacent to the MEW Site may pose potentially significant ecological risks and, if so, to recommend additional site characterization needs in support of a BERA. This evaluation expands upon a previous ecological risk screening assessment prepared by ENVIRON (2005), by incorporating an analysis of additional biota sampling performed by the MEW Site Trust Fund Donors in December 2005.

The MEW Property is located at 824 South Kingshighway in a primarily commercial/industrial area of Cape Girardeau, Missouri (Figure 1 and Figure 2). The Site includes the MEW Property and downgradient portions of adjacent properties southeast of the MEW Property, potentially impacted by historical surface runoff from the MEW Property ("Off-Property Area"). Between 1953 and 1992, electrical transformers, motors, and equipment controls were sold, serviced, and remanufactured at the MEW Property. Commercial operations ceased at the MEW facility in 1992.

A previous study conducted on behalf of the Missouri Department of Natural Resources (MDNR) and USEPA Region VII reported the presence of Aroclor 1260 (a commercial mixture of polychlorinated biphenyls [PCBs]) on the MEW Property and adjacent areas (EarthTech 1990). The presence of PCBs at the MEW Property is believed to have resulted from historical handling and storage of electrical transformer fluids (EarthTech 1990). Although these historical practices at the MEW Property are suspected to have contributed to the presence of PCBs in the Off-Property Area (EarthTech 1990), other potential sources of PCBs may exist in the area.

To support the evaluation of potential ecological risks, Komex conducted sampling in wetland areas southeast of the MEW Property ("Off-Property Areas") for analysis of chemicals of potential concern (COPCs), as defined in the Remedial Investigation (RI). Sampling was conducted from August 11 through 16, 2003, in accordance with the Komex Sampling Plan (Komex 2003a, 2003b). The sampling areas included the U.S. Army Corps of Engineers (ACOE) channel (sampling locations A, B, and C), a retention pond (sampling locations D1, D2, and D3), a drainage ditch along Wilson Road (sampling locations E, F, G, and H), and a wet meadow (sampling locations I1 and I2) (Figure 3). Surface water, soil, and sediment samples (Table 1) were analyzed for COPCs. Benthic macroinvertebrate samples were also collected from the ACOE channel and retention pond for taxonomic evaluation. In addition, fish were collected from the ACOE channel and retention pond on December 16, 2005, in accordance with the Standard Operating Procedure (SOP) approved by the U.S. Environmental Protection Agency (USEPA) Region VII on October 13, 2005. While both fillet and whole body fish tissue samples were analyzed for PCBs by USEPA Method 8082, only the whole body results are pertinent to ecological exposures and risks. Site visits to support the ecological risk evaluation were conducted by Komex in June 2003 and by ENVIRON in November 2004.

1.2 Technical Approach

This ecological risk screening evaluation for the Off-Property Area was conducted in a manner generally consistent with USEPA ecological risk assessment (ERA) guidance (e.g., USEPA 1997, 1998, 2000, 2001a, 2001b) and is based on ecological studies and sampling performed by Komex (2003a, 2003b). The SLERA addresses potential ecological risks posed by the presence of chemicals in the Off-Property Area. The ecological risk screening evaluation includes the following steps (USEPA 1997, 2000, 2001b):

Step 1: Screening-level problem formulation and ecological effects evaluation

Step 2: Screening-level preliminary exposure estimate and risk calculation

Step 3a: Introduction of information to refine SLERA risk estimates (initial step of the BERA problem formulation)

These three steps are components of the USEPA (1997) eight-step ERA process, as illustrated on Figure 4. Steps 1 and 2 comprise the SLERA. The SLERA provides a conservative estimate of the maximum potential ecological risks and incorporates uncertainty in a precautionary (i.e., conservative) manner. The overall goal of the SLERA is to determine whether: (1) there is a high probability that there are no significant ecological risks; or (2) there is a need for additional evaluation of potential risks (USEPA 1997, 2000). In the event that additional evaluation is recommended, it may involve further sampling and analysis, refined risk calculation, remedial action[1], or a BERA. BERAs (Step 3 through 8) are more complex than SLERAs and typically incorporate more realistic exposure and effects information. Chemicals, receptors and pathways that are screened out in the SLERA are not typically carried forward in the BERA.

Consistent with USEPA (2000) guidance, this ecological risk screening evaluation includes Step 3a, which is the first of two parts of the BERA problem formulation. As stated by USEPA (2000):

> "*Step 3a serves to introduce information to refine the risk estimates from steps one and two [of the SLERA]. For the majority of sites, ecological risk assessment activities will cease after the completion of Step 3a. At many sites, a single deliverable document consisting of the reporting of results from Steps 1, 2, and 3a may be submitted.*"

As illustrated on Figure 4, the ERA process includes a series of scientific management decision points (SMDPs) (USEPA 1997, 2000). SMDPs are steps in the process where risk management decision-making typically occurs. SMDPs help focus the ecological assessment and identify

[1] Generally, when remedial action is undertaken following completion of a SLERA, that action is not ecologically-driven (e.g., if imminent hazards to human health are predicted).

what, if any, additional information or analysis is necessary to help make risk management decisions at a site. In this risk evaluation, an SMDP is included at the conclusion of Step 3a. That SMDP asks whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for any further action on the basis of ecological risk. If further action is warranted, the SMDP includes recommendations for the nature of that action.

1.3 Report Organization

Section 2 of this ecological risk screening evaluation report presents Step 1 of the SLERA (screening-level problem formulation and ecological effects evaluation). Section 3 presents Step 2 (screening-level exposure estimate and risk calculation) of the SLERA. Section 4 presents information for refining SLERA risk estimates, consistent with Step 3a of the BERA problem formulation, and the SMDP. Section 5 presents conclusions and recommendations, while Section 6 lists the references cited in this report. Appendices A through G present additional technical background and data to support the MEW ecological risk screening evaluation.

2.0 STEP 1: SLERA PROBLEM FORMULATION AND ECOLOGICAL EFFECTS EVALUATION

Step 1 of a SLERA involves the screening-level problem formulation (Section 2.1) and ecological effects evaluation (Section 2.2).

2.1 Screening-Level Problem Formulation

The overall goals of the screening-level problem formulation are to describe the environmental setting of the Off-Property Area and to preliminarily evaluate ecological exposure pathways and assessment endpoints. The screening-level problem formulation defines the rationale for the SLERA and the methods for analyzing risks (USEPA 1998). Information pertaining to site characterization, potential receptors, and ecosystem characteristics is considered in problem formulation, as is information on the sources and effects of the stressors (USEPA 1998). The screening-level problem formulation establishes the overall goals, breadth, and focus of an ERA (USEPA 1997, 1998).

The screening-level problem formulation describes: (1) the environmental setting; (2) detected chemicals; (3) chemical fate and transport pathways; (4) mechanisms of ecotoxicity; (5) potentially exposed receptors; (6) potentially complete exposure pathways; and (7) generic assessment and measurement endpoints. These elements are integrated to yield two main outputs of the problem formulation: (1) assessment and measurement endpoints that reflect management goals and ecosystem attributes; and (2) a conceptual site model that describes the relationships between chemicals and ecological receptors.

This problem formulation considered several studies previously conducted at the site, including:

- Remedial Investigation Report (EarthTech 1990)
- Supplemental Hydrogeological Investigation Report (EarthTech 1991)
- Re-evaluation of Groundwater Conditions and Conceptual Model Report (Komex 2001a)

- Sampling and Analysis Plan 2003 (Komex 2003a)
- MEW Ecological Walk and Supplement to Planning Documents – Draft (Komex 2003b)
- Work Plan 2003. Remedial Design Investigation, Feasibility Study, and Risk Assessment at Missouri Electric Work (MEW) Site (Komex 2003)
- Groundwater Remedial Investigation, Missouri Electric Works (MEW) Site, Cape Girardeau, Missouri (Komex 2005)

Results of the August 2003 ecological sampling performed by Komex (2003a) are presented in Tables 1 through 5 and Appendices A through C. A review of previous Off-Property Area data has been prepared by Komex and is provided in Appendix D.

2.1.1 Environmental Setting

The environmental setting encompasses a general description of the Site and its history, local geology and hydrogeology, and habitat types.

2.1.1.1 Site Description and History

The MEW Property is approximately 6.4 acres in area and is bounded to the north, south, and east by retail, light industrial and office developments, and to the west by Missouri State Highway 61. Surface runoff from the MEW Property and groundwater underlying the Property generally flow to the south towards Wilson Road (located approximately 300 feet south of the MEW Property) and the Off-Property Area. The Off-Property Area includes an ACOE engineered channel (south of Wilson Road), a retention pond, a drainage ditch along Wilson Road, and an undeveloped wet meadow that lies between Wilson Road and the ACOE channel. All land within the MEW Site (including both the MEW Property and the Off-Property Area) is zoned for either light or heavy industrial land use (Figure 2). Most of this area is regularly mowed. In 2004, trees, brush and other bank vegetation were removed from the western portion of the ACOE channel and from the drainage channels south of Wilson Road.

Commercial operations at the MEW facility ceased in 1992. Between 1953 and 1992, electrical transformers, motors, and equipment controls were sold, serviced, and remanufactured at the MEW Property. During these historical operations, MEW recycled materials from old equipment and recovered copper wire and dielectric fluid from transformers. The salvaged transformer oil was filtered through Fuller's Earth for reuse; approximately 90 percent of the oil was recycled (EarthTech 1990). Chlorinated solvents were also historically used at the MEW Property (EarthTech 1990). The former MEW plant and general office buildings remain standing near the northwest corner of the MEW Property, but are unoccupied.

Investigations of soil and groundwater at the MEW Property were conducted in 1989 and 1990 by The Earth Technology Company (EarthTech 1990, 1991). During these investigations, PCBs were identified in MEW Property soils, from the surface to approximately 24 feet below ground surface (bgs). Chlorinated volatile organic compounds (VOCs), including methylene chloride, chlorobenzene, and 1,1,1-trichloroethane, were also detected in MEW Property soil. To address soil contamination at the MEW Property, remediation activities were conducted in 1999 and 2000 to remove affected soil down to a maximum depth of 27 feet bgs. The excavated soil was treated by thermal desorption at the MEW Property. Treatment was completed in September 2000 (Komex 2001a, 2003c). Additional investigations focusing on groundwater conditions were conducted at the MEW Property by Komex in 2001, 2002, 2003, and 2004.

Investigations of groundwater have detected the presence of chlorinated hydrocarbons (chlorobenzenes, chloroalkanes, and chloroalkenes), benzene, and PCBs at the MEW Property. Monitoring wells were installed on the MEW Property and downgradient areas to evaluate transport of these chemicals in groundwater. Figure 2 shows the location of the monitoring wells. Concentrations of PCBs in groundwater samples have declined since the excavation of impacted soils (Komex 2003c).

Previous investigations indicate that PCBs may have migrated from the MEW Property south to nearby properties, primarily through overland transport of stormwater and entrained solids (EarthTech 1990). Komex (2003a) sampling results indicate the presence of PCBs possibly associated with drainage from the MEW Property, as discussed in Section 2.1.2. However, these

PCBs also could be associated with other sources, such as roadways and commercial/industrial businesses in the area.

2.1.1.2 Geology and Hydrogeology

The following summaries of site geology and hydrogeology were derived from previous investigations (EarthTech 1990, 1991; Komex 2001a, 2001b, 2001c, 2002a, 2002b, 2003d, 2003e, 2003f).

Geology

In southeastern Missouri, where the site is located, the uppermost geological formation is commonly a surficial, undifferentiated Pleistocene-age loess deposit consisting predominantly of loosely consolidated silts and silty clays. Where the loess is encountered, it varies in thickness by up to 30 feet. In the vicinity of the site, the Pleistocene-age loess of Cape Girardeau is underlain by the Plattin Formation, a 400-feet thick limestone, which is slightly dolomitic and fossiliferous and dips to the northeast at a maximum of 2 degrees. The underlying Joachime Dolomite outcrops approximately 1.2 miles to the southwest of the MEW Property. The United States Geological Survey (USGS) solid geology map shows two faults running northwest to southeast passing close to the western boundary of MEW Property.

Boreholes drilled at the MEW Property, in the wet meadow area south of the MEW Property, and south of Wilson Road are generally consistent with the regional geology described above. The native, surficial soil at the MEW Property consists of 15- to 25-feet thick loess that is underlain by a brownish-red gravelly clay. The thickness of surficial deposits beneath the wetland area varies from 20 feet (near Wilson Road) to 147 feet (within the wet meadow). The increased thickness of alluvium encountered under the wet meadow is caused by a depression, possibly a buried former river channel, in the surface of the limestone. Boreholes drilled in the depression have shown that the surficial deposits in this area consist of silty sands.

Hydrogeology

The majority of wells on the MEW Property are completed within the weathered zone of the bedrock, with screened depths of less than 60 feet bgs. Hydrographs indicate that groundwater within the weathered and intermediate zones of the limestone has hydraulic continuity. However, hydrograph responses from monitoring wells, completed in the deep limestone and in the weathered and intermediate zones, suggest limited hydraulic continuity between the intermediate and deep limestone.

The groundwater table at the MEW Property is approximately 40 feet bgs and is generally within the limestone. The loess is generally unsaturated, with the exception of some limited areas of perched water, and where the loess deposits occur within fractures of the bedrock below 40 feet bgs. The groundwater table in wells south of Wilson Road is between 0.43 feet and 3.0 feet bgs.

Data from monitoring wells on the MEW Property show that groundwater flows southeast towards the Cape LaCroix Creek. An upward hydraulic gradient suggests that groundwater within the limestone discharges to the creek. The majority of flow in the limestone likely occurs within the fractures of the weathered and intermediate zones of limestone.

2.1.1.3 Site Characterization and Habitat Types

This SLERA addresses potential ecological risks posed by the presence of chemicals in the Off-Property Site, located to the southeast of the MEW Property, south of Wilson Road. As described previously, the Off-Property Site includes the ACOE channel, a man-made retention pond, a drainage ditch running along Wilson Road, and a wet meadow located between Wilson Road and the ACOE channel. The area is zoned for light and heavy industrial land use, but is currently undeveloped, with no buildings or other structures. Most of the area is vegetated with grasses and is regularly mowed. Trees and other bank vegetation along the western portion of the ACOE channel were recently removed.

The following descriptions of each part of the Off-Property Area are based on site visits performed by Komex on June 9 and 10, 2003 and by ENVIRON on November 30, 2004. During the Komex site visit, ecological checklists were completed (Appendix E), which provide further details regarding the habitat types of each part of the Off-Property Area.

2.1.1.3.1 ACOE Channel

The ACOE channel is a tributary to the Cape LaCroix Creek, which flows into the Mississippi River approximately one mile east of the site (EarthTech 1990). It has been channelized for flood containment by the ACOE (Figure 3). The ACOE channel lies within an area zoned for light and heavy industrial land use. The ACOE channel is periodically maintained for flood control. For example, downstream beaver dams were cleared in 2004 to prevent flooding in the area of the channel. All vegetation along the western portion of the ACOE channel was cleared in 2004, possibly in connection with on-going efforts to sell the surrounding property.

The ACOE channel is located south of the wet meadow and contains a wetland area, as defined by ACOE (1987, 1992). The ACOE channel area covers approximately 3.6 acres and, according to Komex, shows a dominance of hydrophytic plants, standing water between 6 inches and 36 inches deep, and sediment with high organic content. The marginal areas of the ACOE channel, where sampling by Komex occurred (Figure 3), lie within a riparian corridor that is transitional between permanent saturated areas and upland areas (Leonard et al. 1992). Wetland determination forms for the ACOE channel are included in Appendix F. According to Komex, the three ACOE criteria (vegetation, soils, and hydrology) (ACOE 1992) are met as follows:

- Greater than 75% of the plants identified are either facultative or obligate hydrophytic plants;
- The soils show evidence of being hydric soils, in that reducing conditions were observed through the presence of gleyed, high organic content of the soil (sediment) and a sulfidic odor; and
- Following heavy rainfall events, the area was inundated by standing water, with up to 36 inches observed in the ACOE channel.

According to Komex (see Appendix C), the banks of the ACOE channel contain numerous riparian plants, including hackberry (*Celtis spp.*), elder (*Sambucus, spp.*), willow (*Salix, spp.*), and cottonwood (*Populus, spp.*), with an understory of poison ivy (*Rhus radicans*), marsh milkweed (*Ascelepias incarnata*), tickseed (*Corispermum spp.*), jewelweed (*Impatiens capensis*), and others. Duckweed (*Lemna, spp.*), emergent reeds (*Juncus, spp.*), and arrowhead (*Sagitaria, spp.*) were observed on portions of the water surface in the ACOE channel in the vicinity of the pond.

In the ACOE channel, Komex observed waterfowl, fish, frogs, small birds, and evidence of mammals in the vicinity (e.g., beaver-gnawed tree stumps). However, the channel's maintenance (i.e., channelization and vegetation removal), as well as its narrow width, shallow depth, and mucky substrate, limit the quality and quantity of suitable habitat for sustaining substantial populations of ecological receptors. Thus, regardless of chemical impacts, the ACOE channel is unlikely to attract or sustain large or diverse populations of wildlife. The quality and quantity of the habitat provided by the ACOE channel may support limited or temporary communities of tolerant invertebrates, small fish, and common species of small birds and mammals.

2.1.1.3.2 Retention Pond

A 1.4 acre man-made retention pond lies along part of the southern border of the wet meadow, adjacent to the ACOE channel, in an area zoned for light industrial land use. The pond is about 4 feet deep in the center. According to Komex (see Appendix C), the banks of this pond are vegetated with hackberry (*Celtis spp.)*, elder (*Sambucus, spp.*), willow (*Salix, spp.*), and cottonwood (*Populus, spp.*), with an understory composed primarily of poison ivy (*Rhus radicans*).

Surface water runoff from the wet meadow appears to enter the retention pond. Although there is a possible groundwater connection to the pond, chemical transport modeling indicates no significant lateral transport of PCBs through subsurface mechanisms (Komex 2003f).

Komex observed large mouth bass in the pond, as well as birds within the riparian margin. Beaver-gnawed tree stumps were observed near the banks of the pond. The retention pond's narrow riparian margin, man-made features, small size, and shallow depth substantially limit the quality and quantity of suitable habitat for sustaining populations of ecological receptors. Thus, regardless of chemical impacts, the retention pond is unlikely to attract or sustain large or diverse populations of wildlife. The quality and quantity of the habitat provided by the retention pond may support small communities of tolerant invertebrates, small fish, and common species of small birds and mammals.

2.1.1.3.3 Drainage Ditch Area along Wilson Road

Surface water runoff from the MEW Property crosses Wilson Road and collects in a drainage ditch located immediately south of and parallel to Wilson Road. Runoff then flows south across the wet meadow toward the ACOE channel. As previously noted, trees and large brush were removed from the drainage ditch area in 2004. The drainage ditch along Wilson Road lies within an area that is zoned for light and heavy industrial land use. The drainage ditch was likely constructed to collect runoff from Wilson Road; thus, the MEW property is unlikely to be the only source of runoff (and chemical impacts) to the drainage ditch.

The drainage ditch's man-made features, narrow width, and shallow depth substantially limit the quality and quantity of suitable habitat for sustaining populations of ecological receptors. Thus, regardless of chemical impacts, the drainage ditch is unlikely to attract or sustain diverse populations of wildlife. The quality and quantity of the habitat provided by the drainage ditch may support communities of tolerant invertebrates and common species of small birds and mammals.

2.1.1.3.4 Wet Meadow

The undeveloped area between Wilson Road and the ACOE channel (Figure 3) covers approximately 20 acres and has been defined by ACOE (1992) as a wet meadow. The wet meadow is regularly mowed. The southwestern portion of the wet meadow was cleared of trees and other large brush in 2004. The western portion of the wet meadow is zoned for heavy industrial land use, while the eastern portion is zoned for light industrial land use. The wet meadow area was reportedly drained at one time, and the surface elevation has been raised by up to 6 feet using fill over the past 15 years (Vaughn 2003).

According to Komex, the ACOE (1992) criteria for wetland delineation for vegetation, soils, and hydrology are met in the wet meadow, as follows:

- Greater than 75% of the plants identified are either facultative or obligate hydrophytic plants;
- The soils show evidence of being hydric soils, in that reducing conditions are observed as mottling, gleyed2, and a sulfidic odor; and
- Indicators of wetland hydrology are present including sediment deposits, drift lines, and water marks on the vegetation.

According to Komex, a transect through the wet meadow demonstrated the presence of both obligate and facultative wetland plants and showed evidence of recent inundation (algae accumulated on stems). Soils removed from the surface showed low chromic color and mottling and smelled sulfuric. This area has been documented as a wetland in the past (EarthTech 1990), and the presence of standing water or saturated soils and hydrophytic plants indicates that at least part of this area meets ACOE's (1987, 1992) definition of a wetland. Wetland determination data forms confirming this designation are included in Appendix F.

According to Komex (see Appendix C), numerous riparian plants were observed within the wet meadow area, including black-eyed susan (*Rudbeckia hirta*), blue-eyed grass (*Sisyrinchium spp.*), and sweet clover (*Ozmoriza purpureum*). Other plant species observed included hibiscus (*Hibiscus moschuitos*), flat topped aster (*Aster spp.*), and bog berry (*Rubus lacinitus*).

[2] Gley is a sticky clay soil or soil layer formed under the surface of some waterlogged soils.

A geophysical investigation and the installation of monitoring wells were conducted to determine the condition and characteristics of groundwater underlying the wet meadow area. While the MEW Property is approximately 45 feet higher in elevation than the wet meadow, indicating the potential for a hydraulic connection, shallow boreholes to 5 feet bgs (Appendix F, soil log in wetland delineation forms) reveal the presence of a low conductivity layer that may restrict infiltration of water.

In the wet meadow and its margins, Komex observed algae, wetland plants, birds, and small mammals. While conditions had been dry for some time prior to the site visit, clumps of algae were observed attached to vegetation. Many obligate hydrophytic (wetland) plants were identified. Emergent vegetation was observed in the ditch parallel to Wilson Road, particularly in the depressions associated with culvert discharge that extend into the wet meadow. Small fish (probably fathead minnow) were observed in the waters discharged from the culverts into depressions prior to entering the wet meadow. Bird and small mammal tracks were observed in these culvert areas. Many unidentified small birds were noted. A mammal skull, likely an opossum, was found in the wet meadow. Thus, the wet meadow offers a moderate-sized area of fair quality habitat within an otherwise developed area. As such, the wet meadow may support small populations of invertebrates and wildlife.

2.1.2 Summary of Chemicals Detected

To support the evaluation of potential ecological risks at the MEW Site, Komex collected environmental samples from the four subareas of the Off-Property Area between August 11 and August 16, 2003. Sampling was conducted in accordance with the Komex sampling plan (Komex 2003a, 2003b). Areas sampled included the ACOE channel (sampling locations A, B, and C), the retention pond (sampling locations D1, D2, and D3), the drainage ditch (sampling locations E, F, G, and H), and the eastern section of the wet meadow (sampling locations I1 and I2) (Figure 3). Sediment, surface soil, and surface water samples were analyzed for PCBs, VOCs, and semi-volatile organic compounds (SVOCs), in accordance with USEPA Method 8082, 8260B, and 8270C, respectively (Table 1). In addition, water pH, conductivity, dissolved oxygen, temperature, salinity, and turbidity were measured at locations where surface water was present, and found to be within normal ranges for freshwater (Table 5).

Target analytes were selected based on the designation of COPCs in the RI. COPCs were selected based on potential association with historical operations of the MEW Property (Komex 2005). Inorganic chemicals were not included as target analytes, because they had been excluded from the list of COPCs based on concentrations that were generally consistent with background (Komex 2005). The following VOCs, PCBs, and SVOCs were detected by Komex in at least one sample:

Chemical	**Sediment**	**Soil**	**Surface Water**
Acetone	X	X	--
Benzene	X	X	--
Butanone, 2- (MEK)	X	X	--
Carbon Disulfide	--	--	X
Chloroform	--	--	X
Chloromethane	--	--	X
Ethylbenzene	X	X	--
Toluene	X	X	--
Trichloroethane, 1,1,1-	--	--	X
m,p-Xylene	X	X	--
o-Xylene	X	X	--
Aroclor-1260 (PCB mixture)	X	X	--
Bis(2-ethylhexyl)phthalate (BEHP)	--	--	X
Benzo(a)anthracene	X	X	--
Benzo(a)pyrene	--	X	--
Benzo(b)fluoranthene	X	X	--
Chrysene (1,2-Benzphenanthracene)	X	X	--
Fluoranthene	X	X	--
Methylcylohexane	X	X	--
Phenanthrene	--	X	--
Pyrene	X	X	--

Of the chemicals listed above, only Aroclor 1260, benzene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(a)athracene, and chloroform were identified in the RI as COPCs potentially associated with historical operations at the MEW Property (Komex 2005)[3]. There are numerous potential Off-Property sources of the low levels of other SVOCs and VOCs detected in surface water, soil and sediment, particularly given the presence of Missouri State Highway 61, South Kingshighway, warehouses and other commercial/industrial facilities in the immediate vicinity. Furthermore, some to the constituents detected (e.g., acetone and BEHP) are common laboratory contaminants. However, in keeping with USEPA (1997) methods, all detected chemicals, as summarized in Table 6, were evaluated in the SLERA.

2.1.3 Description of Chemical Fate and Transport Pathways

The next step in the screening-level problem formulation is consideration of fate and transport pathways that might result in chemical exposure to individual organisms or populations of organisms. Soil remediation completed at the MEW Property in 2000 is believed to have eliminated the primary source of PCBs (i.e., MEW Property soils), as well as transport pathways from that source to the Off-Property Area (Komex 2001c, 2003c). However, prior to remediation, overland runoff from the MEW Property appears to have transported some chemicals off-site, based on the following observations:

- Earth Tech (1990) reported that PCB concentrations decreased with distance from the MEW Property ;
- Stormwater flow patterns during rainfall events follow a gradient from the MEW Property south to nearby areas;
- Rudolph (2003) reported observing sediment transport off-site during rainfall events at the property.

[3] BEHP is also listed by Komex (2005) as a COPC. However, Komex (2005) determined that the levels detected in surface water sample results (i.e., 9 ug/L or less) are not considered to be reliable at these concentrations. Specifically, BEHP is a common laboratory and sample-handling contaminant introduced by plastics and concentrations up to 19 ug/L were detected in equipment blanks from the Site (Komex 2005).

Surface flow from the eastern half of the MEW Property moves towards the ravine at the eastern boundary of the Property. The ravine drains to Wilson Road and adjacent ditches. While some of the water flows on the north side of Wilson Road, most crosses the road to flow in a ditch and culvert system along the south side of the road. Three culverts cross under Wilson Road, downgradient from the eastern drainage ravine, and contribute drainage water from both the MEW Site and businesses located south of the site. The water that accumulates in the depressions at culvert outfalls then flows into the wet meadow in small channels towards the ACOE channel, entering the channel upstream (west) of the retention pond. A map showing dominant paths of surface water flow is included (Figure 5).

2.1.4 Mechanisms of Ecotoxicity

Mechanisms of ecotoxicity for each chemical vary depending on a wide range of factors, such as concentration, species exposed, exposure route (e.g., ingestion or direct contact), and environmental factors (e.g., pH, temperature, organic carbon, oxygen levels). As recommended by USEPA (2001a), general mechanisms of ecotoxicity for each class of compounds are summarized below. These mechanisms are presented without consideration of chemical concentrations, as the intent is to convey a general understanding of the range of potential ecotoxicological effects. The specific ecotoxicity benchmarks considered in the MEW SLERA are discussed in Section 2.2.

<u>Volatile Organic Compounds</u>

VOCs attenuate rapidly in environmental media due to their inherent volatility. Given these characteristics, reports on the ecotoxicity of VOCs under field conditions are limited. In laboratory test organisms, inhaled VOCs are typically metabolized in the liver, which may cause liver damage or the release of more toxic secondary metabolites. VOCs tend not to bioaccumulate, because they are so rapidly metabolized. Excessive exposures to some VOCs may cause neurological damage, and some are mutagenic, carcinogenic, fetotoxic, and/or teratogenic at high levels of exposure under laboratory conditions (USEPA 2003a).

Semivolatile Organic Compounds

SVOCs include a wide variety of compounds, such as phenols, organochlorine alkenes, phthalates, polycyclic aromatic hydrocarbons (PAHs), and pesticides. SVOCs vary greatly in their toxicity, mechanisms of action, bioaccumulative potential, and tendency to metabolize. Excessive exposures to SVOCs or their metabolites may cause neurological damage, and some are mutagenic, carcinogenic, fetotoxic, and/or teratogenic at high levels of exposure under laboratory conditions (USEPA 2003a; Newman 1998; Sample et al. 1996). Although PAHs have been shown to cause changes in liver enzymes and cell membranes, in general, they are not viewed as acutely toxic. Sublethal effects attributed to PAHs in aquatic animals include reduced reproductive ability and fertility, developmental abnormalities, delayed or retarded maturation, histological changes, and carcinogenesis. Some PAHs are persistent and are known to be mammalian carcinogens, although the ecological effects of PAHs are not well characterized. Most PAHs sorb to solid particles in the environment, which reduces their bioavailability and toxicity.

PAHs, such as benzo(a)pyrene, chrysene, fluoranthene, and pyrene, are released through fossil fuel combustion. Primary non-point sources of PAHs to the environment are aerial fallout (or rainout), road runoff (from the wear and leaching of asphalt, tire wear, vehicle exhaust, and dripping vehicle fluids), and combined storm sewer runoff (domestic sewage contains some PAHs).

Polychlorinated Biphenyls

PCBs are mixtures of up to 209 different biphenyl congeners with varying degrees of chlorination. The composition of commercial PCB mixtures can be altered in the environment through chemical and biological transformation, volatilization, and preferential bioaccumulation. The more highly chlorinated PCB congeners tend to adsorb strongly to sediment and soil and persist in the environment. The stability and lipophilicity of PCBs make them bioaccumulative. Effects that have been associated with high levels of exposure to PCBs in laboratory test animals include thyroid, liver, immunological alterations, neurodevelopmental changes, reproductive toxicity, reduced birth weight, dermal and ocular changes, and cancer (ATSDR 2000).

Reproductive impairment and juvenile mortality are generally viewed as the most sensitive ecotoxicological effects of PCBs.

2.1.5 Potential Ecological Receptors

In this subsection, categories of potential ecological receptors are identified based on the environmental setting, with the goal of focusing the SLERA. This information informs the conceptual site model (CSM) illustrated in Figure 6. The CSM describes how chemical substances enter a system, how they are transported within the system, and how ecological receptors may be exposed. As such, it provides a framework for assessing potential risks from chemical substances.

A variety of plants, invertebrates, fish, and wildlife (e.g., small birds, mammals, amphibians and reptiles) were observed in the Off-Property Area during site walk-throughs performed by Komex in 2003 (see Appendix C) and ENVIRON in 2004. The Missouri Department of Conservation (MDOC) has not identified records of any species or habitats with either Federal or State restrictions within a one-mile radius of the MEW Property (MDOC 2005). Komex did not identify any threatened or endangered species during its site reconnaissance. Although receptors may include species, populations, communities, or critical habitats (USEPA 1999), this SLERA conservatively focuses on potential risks to individual organisms.

2.1.6 Potentially Complete Exposure Pathways

A complete exposure pathway is one in which chemicals can be traced or are expected to travel from the source to a receptor (USEPA 1997). Therefore, a chemical, its release and migration from the source, a receptor, and the mechanisms of toxicity of that chemical must all be present in order for a pathway to be considered complete.

Based on the observed water flow, habitat characteristics, and analytical information on the presence and spatial distribution of chemicals potentially related to the MEW Property, both direct and indirect exposure pathways likely exist for plant, invertebrate, fish, bird, and mammal species that inhabit the area downgradient of the MEW Property. Possible exposure routes include inhalation, ingestion through diet, and ingestion of sediment, soil, and/or surface water.

2.1.7 Generic Assessment and Measurement Endpoints

Assessment endpoints are the explicit expression of ecological entities (e.g., mammal populations) and attributes (e.g., reproductive ability) to be protected (USEPA 1997, 2004a). The selection of assessment endpoints depends on knowledge about the receiving environment, chemicals released (including ecotoxicological properties and concentrations that cause adverse impacts), and the values that will drive risk management decision-making (Suter et al. 1995). According to USEPA (1997), "For the SLERA, assessment endpoints are any adverse effects on ecological receptors, where receptors are plant and animal populations and communities, habitats, and sensitive environments. Many of the ecotoxicity screening values are based on generic assessment endpoints (e.g., protection of aquatic populations or communities from changes in structure or function) and are assumed to be widely applicable to sites around the United States[4]."

Because direct measurement of assessment endpoints is often difficult or impossible, measurement endpoints are used to provide the information necessary to evaluate whether the values associated with the assessment endpoint are being protected. A measurement endpoint is a measurable ecological characteristic and/or response to a stressor (USEPA 1998). Potential adverse effects of chemicals on the survival or reproduction of ecological receptors are indirectly evaluated in the SLERA through hazard quotients (HQs), which are ratios of chemical concentrations to conservative ecotoxicity screening levels (ESLs).

In addition, metrics of benthic community structure are also considered as refined measurement endpoints reflective of the benthic community health. Komex (2003a) collected benthic macroinvertebrate samples at Locations A, B, C, D1, D2, and D3. Benthic sweep and grab samples were collected as described in Komex (2003b), with the exception of the change in

[4] However, it is noted by state and federal regulatory agencies that generic ecotoxicity values are not readily available for amphibian and reptile receptors.

location of sampling area A, which was moved from the western portion of the wet meadow to the eastern portion. More detailed discussion of the sampling methodology is included in Appendix B. The primary metrics used to evaluate these data were: abundance (number of individuals of each taxa), richness (number of taxa), dominant taxa percentage contribution (abundance o f the numerically dominant taxa relative to the total number of organisms in a sample), and tolerance (the organisms' ability to tolerate stressors). Health communities are typically characterized by many species with moderate abundances and the ability to adapt to a range of typical natural environmental conditions. The healthier the community, the greater the richness (i.e., diversity) of species tends to be. Tolerance values range from 0 to 10 for families and increase and increase as water quality decreases. However, high abundances of a few species and/or the percent contribution of the numerically dominant taxon to the total number of organisms may indicate environmental stress. These values may be a sign of conditions that produce an ideal habitat for a few species that are tolerant of chemical contaminants and therefore dominate the habitat (Mandaville 2002).

2.2 Screening-Level Ecological Effects Evaluation

The screening-level ecological effects evaluation involves the identification of appropriate ESLs for each detected chemical in each environmental medium. ESLs are chemical concentrations in environmental media below which there is negligible risk to receptors exposed to those media (USEPA 2000). ESLs are available from a broad range of federal and state sources, one or more of which may be applicable for any given site. However, because ESLs for all media and all receptors may not be available from each source, consideration of a range of sources provides greater opportunity for identification of appropriate ESLs. The selected ESLs for use in this SLERA (SESLs) for sediment, soil, and surface water are listed in Table 7. USEPA Region V ESLs (USEPA 2003b) were selected as primary criteria for this SLERA, because they represent the most comprehensive and most current collection of relevant ecological benchmarks. Most of Region V's ESLs are based on association-based benchmarks protective of benthic invertebrates, fish, and aquatic-feeding wildlife. Region V's ESLs are designated as SESLs, in that they are generally the most conservative (lowest) available. Because USEPA (2003b) ESLs were not available for Aroclor 1260, chloromethane and methylcyclohexane, alternative approaches were employed for these three chemicals, as follows.

In the absence of an ESL for Aroclor 1260 in sediment and soil, USEPA's (2003b) ESL for total PCBs was used in the SLERA. In the absence of a Region V ESL for chloromethane in surface water, the ESL from USEPA Region IV (Simon 2000) was used in the SLERA. None of the available sources of ecotoxicity criteria included ESLs for methylcyclohexane. Therefore, potential risks posed by this chemical were evaluated qualitatively, based on its physicochemical properties, detected concentrations, and its general toxicity.

3.0 STEP 2: SLERA EXPOSURE ESTIMATE AND RISK CALCULATION

Step 2 of the SLERA is comprised of the identification of exposure estimates, risk calculations, and evaluation of uncertainties (USEPA 1997, 2000).

3.1 Screening-Level Exposure Estimates

Consistent with USEPA (1997) guidance, exposure estimates used in the SLERA were the maximum concentrations of chemicals detected in Off-Property Area sediment, soil, and surface water, as listed in Table 8.

3.2 Screening-Level Risk Calculations

Screening-level risks are estimated in this SLERA by calculating an HQ:

$$HQ = \frac{Concentration}{SESL}$$

where:

HQ = hazard quotient (unitless)
Concentration = maximum detected chemical concentration
SESL = screening ecological screening level

In this SLERA, HQs are used as a conservative surrogate for the assessment endpoint, which is the protection of individual organisms and ultimately, wildlife populations. An HQ equal to or less than one (to one significant figure) indicates that adverse effects on individual organisms are unlikely (USEPA 1997, 2000). An HQ greater than one indicates that further evaluation may be necessary to more accurately determine the potential for adverse ecological effects. Therefore, chemicals with HQs greater than one are carried forward for further evaluation, where information such as more reasonable exposure estimates and spatial distribution of chemicals in relation to habitat can be considered. Table 8 lists the maximum exposure concentrations, SESLs, and resultant HQs for each of the ACOE channel, retention pond, drainage ditch, and wet meadow. The following chemicals were retained for further evaluation because their HQs were greater than one:

Sediment

- MEK
- Acetone
- Aroclor 1260
- Benzo(a)anthracene
- Chrysene
- Fluoranthene
- Pyrene

Soil

- Aroclor 1260

Surface Water

- Bis(2-ethylhexyl)phthalate (BEHP)

These chemicals are hereafter referred to as chemicals of potential ecological concern (COPECs). Of the chemicals listed above, only Aroclor 1260 and benzo(a)athracene were identified in the RI as COPCs potentially associated with historical operations at the MEW Property (Komex 2005).

As previously noted, because no ESL is available for methylcyclohexane, screening level risks are evaluated for this chemical in a qualitative manner. Methylcyclohexane was detected in both sediment samples and six out of 12 surface soil samples collected in the drainage ditch along Wilson Road. Concentrations range from 2 to 17 μg/kg (micrograms per kilogram) in sediment and 5.6 to 30 μg/kg in soil. It was not detected in any subarea of the Off-Property Area, other than the drainage ditch. Methylcyclohexane is a volatile compound with low toxicity to aquatic organisms and wildlife. For example, the concentrations lethal to 50 percent of organisms tested

(LC50) for methylcyclohexane for copepods, midges, and snails range from 865 to 1,160 mg/L (Panigrahi and Konar 1989), whereas LC50s for fish (golden shiners and rainbow trout) range from 1.3 to 238,000 mg/L (Klein et al. 1975). These adverse effect concentrations are well above the detection limit for methylcyclohexane in surface water. All surface water results for methycyclohexane were non-detect. For these reasons, methylcyclohexane is not anticipated to pose significant ecological risks, and it is not included in further evaluation (i.e., it is not designated as a COPEC).

As discussed in Section 1.2, SMDPs represent critical steps in the ecological risk assessment process where risk management decision-making occurs. The first SMDP in the ERA process may occur either at the end of Step 2 or Step 3a (USEPA 2000). For purposes of this ecological risk screening evaluation, the SMDP is discussed at the end of Step 3a.

3.3 Evaluation of Uncertainties

A SLERA is designed to provide conservative estimates of the potential risks that may exist for wildlife and, therefore, incorporates uncertainty in a precautionary manner. Uncertainty in an ERA is "the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard or of its spatial and temporal distribution" (USEPA 1997). Uncertainties that may lead to either overestimation or underestimation of risk are associated with each stage of risk assessment. Table 9 summarizes uncertainties that are associated with an ERA.

4.0 STEP 3a: INITIAL BERA PROBLEM FORMULATION

This section presents information for refining the risk estimates, consistent with the initial step of a BERA (Step 3a). The information is designed to more realistically identify the nature and extent of potential ecological risks in order to support informed environmental management decision-making (USEPA 1997, 2000). This step contrasts with the preceding Step 2 of the SLERA, which is designed to conservatively rule out further evaluation of chemicals and media that clearly do not pose significant ecological risks.

The BERA problem formulation (Step 3) is the initial step in the BERA process, as illustrated on Figure 4. According to the USEPA (2000):

> *"The Problem Formulation [i.e., Step 3] is commonly thought of in two parts: Step 3a and Step 3b. Step 3a serves to introduce information to refine the risk estimates from steps one and two. For the majority of Sites, ecological risk assessment activities will cease after completion of Step 3a. At many Sites, a single deliverable document consisting of the reporting of results from Steps 1, 2 and 3a may be submitted. At those Sites with greater ecological concerns, the additional problem formulation is called Step 3b. It is very important at this stage to perform a 'reality check.' Sites that do not warrant further study should not be carried forward."*

Step 3a of the ERA process allows refinement of potential risks using methods similar to those used in Steps 1 and 2 (USEPA 2000, 2001b), as illustrated on Figure 4. Specifically, chemicals identified as COPECs in the SLERA may be eliminated from further consideration based on site-specific factors and refined consideration of potential risks. In particular, additional ESLs may be considered in Step 3a, if needed, to understand the range of potential risks. Step 3a also allows consideration of the spatial distribution of elevated chemical concentrations in relation to relevant ecological habitat, as well as potential risks associated with mean[5], rather than maximum, concentrations. As such, Step 3a is a refinement of the SLERA's ESLs, exposure estimates, and risk characterization, focusing on the chemicals and media for which HQ values greater than one were calculated in the SLERA (i.e., COPECs).

The following subsections present the refined problem formulation (Section 4.1), exposure estimates (Section 4.2), effects characterization (Section 4.3), and risk calculations (Section 4.4).

4.1 Refined Problem Formulation

As described above, the ERA process is iterative. The refined problem formulation establishes the framework for evaluating potential risks posed by those chemicals in sediment, soil, and surface water that were not eliminated through Step 2 of the SLERA (i.e., COPECs).

4.1.1 Refined Identification of Chemicals

In the SLERA, COPECs were selected based on comparison of maximum detected chemical concentrations in sediment, soil, and surface water to the most conservative ESLs. Thus, the HQ values calculated in the SLERA are highly conservative, consistent with USEPA (1997, 2000) guidance. In this section, COPECs are re-evaluated based on refined exposure estimates (e.g., mean concentrations rather than maximum concentrations) and refined effects estimates. HQs are also considered in relation to the benthic macroinvertebrate sampling results. Spatial extent of elevated HQs relative to habitat is also considered.

4.1.1.1 Sediment

In the SLERA, screening level HQ values for MEK, acetone, Aroclor 1260, and certain PAHs exceeded one in sediment samples collected from the ACOE channel, retention pond, or drainage ditch along Wilson Road. These COPECs are discussed separately below.

[5] All mean concentrations employed throughout the report are calculated assuming that all non-detect values are equal to one-half of the detection limit.

4.1.1.1.1 MEK

A common solvent (NLM 2004), MEK was detected in one of three sediment samples from the ACOE channel. MEK was not detected in either the retention pond or the drainage ditch. MEK also was not detected in any of the surface water samples from the ACOE channel. The HQ calculated using the mean of the three sediment samples from the ACOE Channel (assuming ½ the detection limit for the two non-detect values) is one. The sediment SESL for MEK was derived by USEPA (2003b) from the surface water SESL, using conservative equilibrium partitioning. Although MEK is present in sediment, the concentration is not sufficient to cause exceedance of water quality criteria (i.e., the surface water SESL). Because MEK is volatile, it does not persist in the environment. Komex (2005) did not consider MEK to be a COPC potentially associated with historical operations at the MEW Property. For all of the above reasons, MEK is not expected to pose a significant ecological risk, and it is not considered further in this evaluation.

4.1.1.1.2 Acetone

Acetone is a common solvent (NLM 2004) and laboratory contaminant. Maximum detected concentrations of acetone in sediment in the ACOE channel, the retention pond, and the drainage ditch exceeded the SESL. While acetone was detected in all three ACOE channel sediment samples and seven out of eight retention pond sediment samples, the MEW Property does not appear to be the source of acetone to these areas, given the concentration gradient. In particular, the concentrations were higher in both the ACOE channel and retention pond compared to sediments from the drainage ditch along Wilson Road. The presence of acetone in the sediments does not result in exceedances of the water quality targets used in deriving the sediment screening levels. Because acetone is volatile, it does not persist in the environment. Komex (2005) did not consider acetone to be a COPC potentially associated with historical operations at the MEW Property. For all of the above reasons, acetone is not expected to pose a significant ecological risk, and it is not considered further in this evaluation.

4.1.1.1.3 Aroclor 1260

The maximum concentrations of Aroclor 1260 in sediment samples collected from the ACOE channel, the retention pond, and the drainage ditch exceeded the SESL for total PCBs (59.8 μg/kg). Comparing mean concentrations to the SESL, the HQs for the ACOE channel, the retention pond, and the drainage ditch are reduced to 8, 3, and 10, respectively. The SESL of 59.8 μg/kg is almost five-fold more stringent than the National Oceanic and Atmospheric Administration (NOAA 1999) freshwater Probable Effects Level (PEL) for total PCBs (277 μg/kg). The PEL represents a concentration above which adverse effects may be expected[6]. Of the three sampling locations in the ACOE channel, only one (Sampling Location B, 950 μg/kg of Aroclor 1260) has a total PCB concentration exceeding the NOAA PEL. All detected PCB concentrations in retention pond sediments are lower than the NOAA PEL. The detected Aroclor 1260 concentration in drainage ditch sediments at Sampling Location G (detected Aroclor 1260 concentration of 1100 μg/kg) exceeds the NOAA PEL of 277 μg/kg, while the concentration in sediments at Sampling Location H (detected Aroclor 1260 concentration of 66 μg/kg) is less than the NOAA PEL. Thus, the distribution of total PCBs in sediment at concentrations above the NOAA PEL suggests that the potential for adverse effects on benthic invertebrates are of a relatively limited spatial scale.

The available benthic community structure data allows still further refinement of the evaluation of potential risks posed by total PCBs in sediment. The benthic macroinvertebrate survey conducted in the ACOE channel does not show evidence of adverse effects on macroinvertebrate communities at this location (Table 10). Of the three sample locations in the ACOE channel where benthic grab samples were collected, the highest PCB concentration in surface sediments was in Location B (950 μg/kg). The tolerance, richness, and dominant taxa at Locations B and C are comparable, even though Location C had the lowest PCB concentration detected in ACOE sediment (180 μg/kg).

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[6] The NOAA PEL is the geometric mean of the 50% of impacted samples and 85% of the non-impacted samples, and according to NOAA represents the level above which adverse effects can be expected.

The benthic macroinvertebrate survey conducted in the retention pond also does not indicate that PCBs are adversely affecting sediment-dwelling communities (Table 10). For example, the lowest PCB concentrations in surface sediments collected from the retention pond were from Sampling Location D3 (three individual samples with a mean PCB concentration of 130 μg/kg). However, within the retention pond, this location had the lowest scores with regard to richness and dominant taxa percentage contribution, and among the lowest scores for tolerance. Overall, the benthic sample results from Sampling Location D1, where PCB concentrations were highest (three individual samples with a mean PCB concentration of 203 μg/kg), are comparable to the results from the other two retention pond sample locations.

Potential risks posed by PCBs to invertebrates and fish can be further refined by considering the Oak Ridge National Laboratory (ORNL) ecological preliminary remediation goal (PRG) for PCBs in sediment. The ORNL (1997) PRGs consider the following ecotoxicity benchmarks: (1) USEPA sediment quality criteria; (2) sediment criteria based on the chronic National Ambient Water Quality Criteria (NAWQC); (3) criteria calculated from the lowest chronic value for fish, daphnids, or other invertebrates in surface waters; (4) the NOAA Effects Range-Median (ER-M); (5) the Florida Department of Environmental Protection PEL; and (6) the Probably Effects Concentration (PEC) selected from the USEPA Assessment and Remediation of Contaminated Sediments (ARCS) Program Report. Using this process, a PRG of 63,000 μg/kg was selected by ORNL (1997) for Aroclor 1260, based on a lowest chronic value (LCV) for fish. All sediment samples contained concentrations of Aroclor 1260 well below this PRG.

Based on all of the foregoing findings, any risks posed by PCBs in sediments to invertebrates and fish are expected to be negligible. However, PCBs are bioaccumulative and may adversely affect reproduction and juvenile mortality in birds and mammals. Consequently, birds and mammals that consume invertebrates and fish were retained for further evaluation, in order to determine whether they may be adversely affected by PCBs in their prey. In addition, because fish tissue samples were necessary to evaluate potential risks to birds and mammals, further evaluation of potential risks to fish is also possible using critical body residues, even though the comparison to the PRG indicated that risks to fish are expected to be negligible.

4.1.1.1.4 Polycyclic Aromatic Hydrocarbons (PAHs)

Several PAHs (benzo[a]anthracene, chrysene, fluoranthene, and pyrene) were detected at one (Location C) of the three sediment samples in the ACOE channel. Of these four PAHs, Komex (2005) had identified only benzo(a)anthrancene as a COPC. No PAHs were detected in sediment in either the retention pond or the drainage ditch or in any surface water sample. Because PAHs were only detected in one sample and because the detection limits for PAHs were elevated, the calculated mean concentration does not accurately reflect sediment conditions.

As described in Section 2.1.4, PAHs are commonly detected in commercial/industrial and urban areas (NLM 2004) at background concentrations of 100 milligrams per kilogram (mg/kg) or more (Neff 1985; Eisler 1987). Areas contributing runoff to the ACOE channel include parking lots, located immediately south of the ACOE channel, and several busy roadways, including the Missouri State Highway 61. PAHs detected in the ACOE channel were not detected in sediments from the drainage ditch along Wilson Road, supporting a hypothesis that the MEW Property is not the primary source of PAHs in ACOE channel sediments.

The presence of urbanized areas, roads, and industrial facilities near the Off-Property Area suggest that refractory or "hard" carbon has likely been deposited in the ACOE channel. Hard carbon results from the incomplete combustion of fossil fuels and is much more effective in binding organic compounds, such as PAHs. Hard carbon is recognized as a factor that can mitigate bioavailability and toxicity (USEPA 2003c). As a result, PAHs in the ACOE channel are likely not bioavailable to aquatic organisms. Furthermore, the potential for adverse effects to aquatic-feeding wildlife from PAHs is very low, since PAHs do not biomagnify through the food web. For instance, fish rapidly metabolize PAHs (Fuchsman 2001). Based on this information, PAHs are not considered further in this evaluation.

4.1.1.2 Soil

PCBs are the only COPEC in soil identified in the SLERA. Aroclor 1260 was detected in 10 out of 12 soil samples collected in the drainage ditch. It was not detected in any of the six soil samples collected in the wet meadow. The SESL used for PCBs in soil was 0.33 μg/kg (USEPA 2003b). Both maximum and mean concentrations of PCBs in soil are more than three orders of magnitude above the SESL (i.e., HQ > 1,000).

Further refinement of risk estimates is possible through application of more appropriate, yet still conservative, ecotoxicological benchmarks. For example, ORNL (1997) has issued PRGs for total PCBs in soil of 371 μg/kg for the shrew, 655 μg/kg for the American woodcock, 1,600 μg/kg for the white-footed mouse, 3,050 for the red fox, 15,500 for the red-tailed hawk, and 138,000 for the white-tailed deer. HQ values based on the mean concentrations of PCBs in drainage ditch soils range from 0.009 to 3, depending on the receptor species, while HQ values based on maximum concentrations of PCBs in drainage ditch soils range from 0.3 to 12. Like the USEPA (2003b) screening level, the ORNL PRG assumes an area use factor (AUF) of 100 percent, inferring that exposed species obtain 100 percent of their prey from the drainage ditch, throughout their lifetimes. Given the very limited extent of the drainage ditch, its poor habitat, and its location adjacent to Wilson Road, this is a highly conservative assumption that likely overstates actual exposures. In light of the bioaccumulative tendency of PCBs and the decision to further evaluate risks posed to higher trophic level organisms by PCBs, PCBs in soils are retained for further evaluation relative to prey consumption by higher trophic level organisms.

4.1.1.3 Surface Water

The SLERA identified BEHP as the only COPEC in surface water. BEHP, found in plastics, is ubiquitous in the environment and is a common laboratory contaminant. BEHP was detected at concentrations above the SESL in surface water samples collected from the ACOE channel, the retention pond, and the drainage ditch. It was not detected in surface water samples collected from the wet area. In the ACOE channel, BEHP was detected in one of three surface water samples. The laboratory holding time was exceeded for that sample. In the retention pond, BEHP was detected in two out of three surface water samples, whereas in the drainage ditch, BEHP was detected in both surface water samples. Komex (2005) excluded BEHP from the list of chemicals released as a result of operations at the MEW Property. BEHP has been reported at similar concentrations in commercial/industrial and urban areas (ATSDR 1996, 2002; NLM 2004). For these reasons, BEHP is not considered further in this evaluation.

4.1.1.4 Fish Tissue

Given the interconnectedness of sediment, surface water, and aquatic biota (e.g., fish), COPECs are also identified for fish tissue. In particular, Aroclor 1260, which was detected in seven whole fish samples collected on December 16, 2005 from the ACOE channel and the retention pond, is designated as a COPEC and is retained for further evaluation (the presence of Aroclor 1254 detected in a fillet sample is discussed in greater detail in Section 4.2.1).

4.1.1.5 Summary of Refined Chemicals

Based on the foregoing refined screening of chemicals, only Aroclor 1260 is retained for further consideration of the potential ecological risks to fish and upper trophic level birds and mammals. The following sections describe the receptors considered for further evaluation (Section 4.1.2) and the refined assessment and measurement endpoints (Section 4.1.3).

4.1.2 Receptors of Interest

Most healthy aquatic and terrestrial ecosystems support a variety of organisms that are potential ecological receptors of chemical exposures, including benthic invertebrates, fish, birds, and mammals. However, it is not feasible to quantitatively evaluate potential risks to all species potentially exposed. Such an effort would also be duplicative because of the similarity of exposure patterns among closely related species and those with like feeding guilds. For these reasons, representative receptors of interest (ROIs) are selected for quantitative evaluation. These ROIs are representative of entire classes of organisms (that is, functional groups).

Selection criteria for ROIs include sensitivity, exposure potential, expected presence in the study area, ecological relevance, trophic level, feeding habits, and the availability of life history information. Potential risks to invertebrates and fish were eliminated in the foregoing screening analysis. Nonetheless, to ensure the conservatism of the analysis, fish are retained as an ROI. In addition, avian and mammalian ROIs (i.e., wildlife) are selected for further evaluation. Each of the wildlife ROIs selected below is included in the USEPA's (1993) compilation of wildlife exposure factors:

- *Belted kingfisher (Megaceryle alcyon)*: Belted kingfishers are piscivorous birds that nest and forage near shallow, open water (USEPA 1993; Brewer et al. 1991). Kingfishers nest in burrows dug into high vertical cutbanks of friable (sandy-clay) soil. Exposure potential for kingfishers is enhanced by the high proportion of fish in their diet and their limited territory sizes.

- *Great blue heron (Ardea herodias).* Great blue herons are evaluated as a second representative of piscivorous birds, in light of differences between herons and kingfishers in foraging ranges, feeding preferences, ingestion rates, and body weights. Fish consumed by great blue herons (up to 30 cm in length) are larger than those consumed by belted kingfishers. Komex (Appendix C) observed a heron near the retention pond.

- *Red-tailed hawk (Buteo jamaicensis)*: As a top predator in the carnivorous bird feeding guild, red-tailed hawks consume small mammals (e.g., meadow voles). A red-tailed hawk might include the Off-Property Area within its territory given that (a) their foraging habitat preference is wetlands, woodlands, and streamside locations; (b) prey items are present within the study area (Appendix C); and (c) home ranges for red-tailed hawks can reach up to 1,500 hectares (USEPA 1993). Komex (Appendix C) observed at least one hawk near the ACOE channel and wet meadow during their site visit in June 2003.

- *Mink (Mustela vison)*: Mink are top-level carnivores that feed on fish, small mammals, birds, eggs, frogs, and macroinvertebrates. Mink are selected as an ROI in part due to their toxicological sensitivity to PCBs. The mink's exposure potential is mitigated by their opportunistic feeding habits and large territory sizes, both of which tend to limit the proportion of diet that may be derived from the study area. Landform characteristics preferred by mink include irregular shorelines with brushy or wooded cover, as opposed to open, exposed banks (Allen 1986). Mink have not been identified in the vicinity of the MEW Property; thus, mink serve as a conservative surrogate for other mammalian species that are more likely to inhabit the Off-Property Area.

4.1.3 Refined Assessment and Measurement Endpoints

Refined assessment endpoints are selected in this subsection, based on ecological relevance, susceptibility (which is a combination of toxicological sensitivity and potential for exposure), and relevance to management goals. Assessment endpoints considered for further evaluation are:

- Survival and maintenance of fish populations;
- Survival and maintenance of bird populations; and
- Survival and maintenance of mammal populations.

"Population" refers to a group of interbreeding individuals of a single species, occurring within a geographic area.

For this refined evaluation of potential risks posed by PCBs to fish, birds and mammals, the selected measurement endpoints are HQs for fish, belted kingfishers, great blue herons, red-tailed hawks, and mink. While HQs for fish are defined as the ratio of the concentration of Aroclor 1260 in fish tissue to a critical body residue (CBR) as reported in the literature, HQs for wildlife are defined as the ratio of estimated doses of Aroclor 1260 (total daily intake or TDI) to doses reported in the literature as threshold of adverse effects (toxicity reference values or TRVs).

4.2 Refined Exposure Evaluation

This section describes the concentrations of PCBs in fish tissue, details the approaches used in this evaluation to estimate exposures for avian and mammalian wildlife, and provides an exposure profile for each selected wildlife ROI.

4.2.1 Fish Tissue Collection and Analysis

To support the evaluation of the effects of Aroclor 1260 on fish and piscivorous wildlife, fish samples were collected from the ACOE channel and retention pond on December 16, 2005, in accordance with the SOP provided by the USEPA Region VII and sampling design agreed upon during the October 13, 2005 meeting in Kansas City, KS between representatives of the MEW Site Trust Fund Donors and USEPA Region VII. When practical, fish were identified to the genus and species. The location of samples collected as well as the length, weight, and number of individuals in each sample were recorded (Table 11). While both fillet and whole body fish tissue samples were analyzed for PCBs by USEPA Method 8082, only the whole body results are used in this exposure evaluation, because they most accurately characterize fish exposures and prey of wildlife species. Fish are identified as being from the retention pond, the ACOE channel (west) and the ACOE channel (east). These correspond to the aquatic features shown in Figure 3, with the pond samples collected in the vicinity of locations Eco-D1, -D2, and –D3, the ACOE west samples collected in the vicinity of locations Eco-B and Eco-C, and the ACOE east samples collected in the vicinity of Eco-A.

Table 12 summarizes the analytical chemistry results for whole body fish tissue, including minimum and maximum detected concentrations, arithmetic means, and frequency of detection. To facilitate risk calculations, samples were classified by the length of fish (i.e., <13 cm, 13-25 cm, and >25 cm). Only Aroclor 1260 was detected in whole body fish tissue. Analytical summary information is provided in Appendix G. The mean and maximum concentrations of PCBs measured in whole fish (2.2 mg/kg and 6.2 mg/kg, respectively) are used to characterize exposures of the fish themselves.

As was previously mentioned, whole body tissue samples are the focus of ecological risk assessments because the whole body results are more representative of piscivorous wildlife feeding habits. Fish fillet samples were collected from the pond to represent potential human health exposures via the consumption of fish, with results from the combined whole body and fillet samples presented in Appendix G of this report. It is noted that Aroclor 1254 was detected in one of the fish fillet samples from the retention pond, but was not detected in any of the whole body samples. Aroclor 1254 was not specifically retained as a COPEC for this expanded SLERA because the concentration of Aroclor 1254 in the fillet tissue (0.76 mg/kg) is approximately an order of magnitude less than that seen for Aroclor 1260 in the whole body tissues (6.2 mg/kg). Furthermore, the methods for estimating risks to 1254 and 1260 are essentially identical (i.e., toxicity reference values are discussed in explicit detail in Section 4.3.2 of this report). As such, Aroclor 1254 is indirectly evaluated in this report and conclusions for 1260 are considered applicable to both Aroclors.

4.2.2 Wildlife Exposure

Exposure of wildlife receptors is evaluated by calculating the estimated total daily intake (TDI) of Aroclor 1260, generally based on the methodology described by USEPA (1993) in the *Wildlife Exposure Factors Handbook.* Dietary uptake is expected to be the most important exposure pathway for PCBs, given their lipophilicity and low solubility in water. Indeed, PCBs were not detected in any surface water sample collected in the Off-Property Area. The following equation is used to calculate total daily intakes for avian and mammalian receptors:

$$TDI = \sum_{i=1}^{n}(Ci \times Pi \times FIR) \times 1/BW$$

where:

TDI = total daily intake (milligrams per kilogram body weight per day or mg/kg body weight-day);

Ci = concentration in i^{th} dietary item (mg/kg);

Pi = fraction of diet as item i (unitless);

FIR = food ingestion rate (kilograms per day or kg/day); and

BW = body weight (kilograms or kg).

This general exposure model was customized to each ROI to reflect prey preferences and foraging behavior. The approaches used to identify appropriate values for these exposure parameters are described below.

4.2.2.1 Exposure Point Concentrations

Measured and estimated exposure point concentrations (EPCs) for wildlife receptors are summarized in Table 13. Both maximum and mean concentrations of Aroclor 1260 in fish are considered as EPCs in the wildlife exposure assessment for kingfisher, heron, and mink. While maximum concentrations ensure the conservatism of the conclusions, mean concentrations more accurately reflect the variety of foraging locations and the equal likelihood that any given point within the exposure unit is the contact location on any given day. Red-tailed hawks do not consume fish; thus, the maximum and average soil concentration from the combined wet meadow and drainage ditch samples (4.4 mg/kg and 0.82 mg/kg, respectively) was used to estimate concentrations of Aroclor 1260 in small mammal prey items consumed by hawks. Where Aroclor 1260 was not detected, one half of the detection limit was used as a proxy concentration along with detected concentrations for estimation of the geometric mean concentration.

In most cases, EPCs for wildlife food items are based on Aroclor 1260 concentrations measured in whole-body fish tissue samples. However, direct measurements of biota tissue are not available for terrestrial prey items. An EPC for small, mammalian prey items is estimated using a soil-to-small mammal uptake factor for Aroclor 1254 identified by Efroymson et al. (1997). This uptake factor of 1.2 is based on the analysis of bioaccumulation models for small mammals by Sample et al. (1997). Sample et al. (1997) compiled chemical concentrations in soil and whole bodies of small mammals for both inorganic and organic chemicals. Small mammals were separated into trophic groups (insectivores, herbivores, and omnivores). Uptake factors were developed for each chemical for all small mammals and also for each trophic group. The uptake factors were then evaluated using simple summary statistics, as well as regression analyses. Model data were validated using estimated and observed concentrations in small mammals. Based on this uptake factor and the maximum and mean soil concentrations of Aroclor 1260 for the Off-Property Area, the estimated maximum and mean concentrations of Aroclor 1260 in small mammal prey of the red-tailed hawk and mink are 5.3 and 0.98 mg/kg, respectively.

4.2.2.2 Dietary Preference and Ingestion Rates

The relative proportion of prey items in the diet of each wildlife ROI are estimated based on information provided by the USEPA (1993). Food ingestion rates are listed by USEPA (1993) for all wildlife ROIs.

4.2.2.3 Other Exposure Parameters

A conservative default value of 1.0 is employed as the absorption factor, meaning that 100 percent of the total amount of Aroclor 1260 ingested is taken up by the ROI. This assumption is likely to overestimate exposures, as laboratory toxicity tests often use highly available forms of the test chemical, whereas Aroclor 1260 in environmental media may be less bioavailable.

AUFs are applied when the foraging area of a ROI is larger than the area being assessed. In this SLERA, an AUF of 1.0 is used for belted kingfishers, given their relatively small territory size. An AUF of 0.5 is conservatively used for great blue herons, red-tailed hawks, and mink, given their expansive territory sizes and the reduced habitat suitability and relatively limited foraging habitat within the Off-Property Area.

Finally, body weights for each wildlife ROI are estimated based on information provided by USEPA (1993). Complete species-specific exposure profiles for each wildlife ROI used in this evaluation are provided in the following sections.

4.2.2.4 Exposure Profile for Belted Kingfishers

Exposure of belted kingfishers to Aroclor 1260 is evaluated by calculating the TDI, as presented in Table 14. The basis for the selected exposure parameter values is provided below.

- *Food ingestion rate* – The value of 0.5 g/g-day is equal to the mean values reported for adult male and female kingfishers by Alexander (1977), as cited in USEPA (1993).

- *Dietary preferences* – Seventy-six percent of the diet of kingfishers is assumed to be composed of aquatic components (fish and crustaceans), based on the average of two studies evaluated by USEPA (1993). For this SLERA, fish represent the aquatic portion of the kingfisher's diet. The remaining 24 percent of the diet is assumed to be composed of non-aquatic prey items, including amphibians, birds, and mammals. Small mammals represent a reasonable surrogate for these terrestrial prey items.

- *Size of fish consumed* – Belted kingfishers typically consume fish up to approximately 13 cm in length; larger fish are swallowed only with difficulty (Kelly 1996; Prose 1985; USEPA 1993). On this basis, small fish (<13 cm) are identified as representative prey for belted kingfishers.

- *Body weight* – 0.15 kg body weight is equal to the mean of values reported for adult male and female belted kingfishers in three studies cited by USEPA (1993).

- *Area use factor* – The AUF for belted kingfishers is conservatively assumed to be 1.0, meaning that belted kingfishers are assumed to obtain 100 percent of their diet from the Off-Property Area.

4.2.2.5 Exposure Profile for Great Blue Herons

Exposure of great blue herons to Aroclor 1260 is evaluated by calculating the TDI, as presented in Table 15. The basis for the exposure parameter values is provided below.

- *Food ingestion rate* – The rate of 0.18 g/g-day reported by Kushlan (1978) and cited by USEPA (1993) applies to adult male and female great blue herons.

- *Dietary preferences* – The various studies cited by USEPA (1993) on dietary composition consistently show a diet for great blue herons that is dominated by fish (94 percent to 100 percent). Great blue herons are conservatively assumed to be entirely piscivorous in this SLERA, meaning that 100 percent of their diet is fish.

- *Size of fish consumed* – Great blue herons are assumed to consume fish ranging in size from 5 to 30 cm, based on Henning et al.'s (1999) analysis. On this basis, small and medium fish (<13 to 30 cm) are identified as representative prey for great blue herons.

- *Body weight* – 2.3 kg is the mean of body weights reported for adult male and female great blue herons in multiple studies cited by USEPA (1993).

- *Area use factor* – Great blue herons travel long distances between roosting and feeding territories (Short and Cooper 1985; USEPA 1993). The limited available information suggests that feeding territories may encompass between 0.05 and 1 mile of stream and that they may forage up to 34 km from their rookery (Henning et al. 1999). Therefore, an area use factor of 0.5 is employed in the SLERA, based on the conservative assumption that great blue herons obtain 50 percent of their diet from the Off-Property Area.

4.2.2.6 Exposure Profile for Red-tailed Hawks

Exposure of red-tailed hawks to Aroclor 1260 is evaluated by calculating the TDI, as presented in Table 16. The basis for the exposure parameter values is provided below.

- *Food ingestion rate* – The food ingestion rate, 0.089 g/g-day, is the mean rate reported for adult male and female red-tailed hawks in multiple studies cited by USEPA (1993).

- *Dietary preferences* – The red-tailed hawk is an opportunistic carnivore. According to USEPA (1993), red-tailed hawks consume small mammals, birds, amphibians, and reptiles. Small rodents constitute the greatest portion of the red-tailed hawk's diet

(Brewer et al. 1991). For this SLERA, small mammals represent 100 percent of terrestrial prey items in the red-tailed hawk's diet (i.e., small mammals, birds, amphibians, and reptiles).

- *Body weight* – 1.1 kg is the mean body weight reported for adult male and female red-tailed hawks in multiple studies cited by USEPA (1993).

- *Area use factor* – Red-tailed hawks are territorial throughout the year, with home ranges varying from a few hundred hectares to over 1,500 hectares, depending on the habitat (Brewer et al. 1991). A mean home range in a forest/wooded/field habitat, calculated from various studies cited in USEPA (1993), is 257 hectares (643 acres). Therefore, an AUF for red-tailed hawks is conservatively assumed to be 0.5, implying that red-tailed hawks are assumed to obtain 50 percent of their diet from the Off-Property Area.

4.2.2.7 Exposure Profile for Mink

Exposure of mink to Aroclor 1260 is evaluated by calculating the TDI , as presented in Table 17. The basis for the exposure parameter values is provided below.

- *Food ingestion rate* – The food ingestion rate of 0.14 g/g-day used in this SLERA is the mean of two values reported in USEPA (1993) by Bleavins and Aulerich (1981) for farm-raised adult male and female mink.

- *Dietary preferences* – Mink consume virtually any type of food they can find, including plants, aquatic invertebrates, small mammals and birds, and amphibians (USEPA 1993). The actual proportions of food types in the diets of mink can be highly variable, since mink are opportunistic feeders. For this assessment, dietary preferences are based on a statewide survey conducted in Missouri by Korschgen (1958), as presented in USEPA (1993). According to this study, 29 percent of the diet of a mink is composed of aquatic prey (i.e., fish and crayfish), while 71 percent is composed of terrestrial prey (i.e., frogs, birds, and other small rodents and mammals). Because the waterways in the Off-Property Area are small, and therefore not highly productive, it is reasonable to assume that only approximately 30 percent of the diet of a mink consists of aquatic prey. In this assessment, fish represent the aquatic portion of a mink's diet and small mammals represent the terrestrial portion.

- *Size of fish consumed* – Mink are assumed to consume fish in all size ranges collected from the Off-Property Area, based on data reported by Chanin (1981), Wise et al. (1981), Erlinge (1969), Cuthbert (1979), Allen (1986), and Hamilton (1940).

- *Body weight* – The body weight of 0.85 kg used in this SLERA is based on the average weights reported by Mitchell (1961), as presented in USEPA (1993) for adult male and female wild mink in summer and fall.

- *Area use factor* – For mink, an area use factor of 0.5 is employed, under the assumption that mink obtain their diet from areas throughout their extensive home ranges (e.g., Arnold and Fritzell 1987; Mitchell 1961). In favorable habitats, mink may utilize 1 to 2 km of stream shoreline (Allen 1986). However, because vegetation has been cleared in portions of the Off-Property Area (which reduces its suitability for mink habitat) and because the small size of the area is likely to limit prey availability, foraging area beyond the Off-Property Area is likely required to sustain individual mink. The assumption that mink obtain 50 percent of their diet from the Off-Property Area is very conservative from a population perspective.

4.3 Refined Effects Evaluation

In this subsection, measures of effects are defined for evaluating responses of ROIs to COPECs. For fish, the measure of effect is the CBR. For wildlife ROIs, the measure of effects is the TRV.

4.3.1 Determination of Critical Body Residue

The CBR for PCBs employed in this evaluation is drawn from the final, peer-reviewed ERA for the Housatonic River PCB site, conducted on behalf of USEPA Region I (USEPA 2004b; http://www.epa.gov/region01/ge/thesite/restofriver/reports/era_nov04/215498_ERA_FNL_TOC

_MasterCD.pdf). USEPA (2004b) reviewed 39 scientific papers to identify the range of concentrations of total PCBs associated with adverse effects on survival, growth, and reproductive success in fish. Because early life stage developmental endpoints are most sensitive to PCBs, adult survival data were not used in the derivation of a CBR. USEPA (2004b) selected a threshold effects concentration of 61 mg/kg ww total PCBs for egg/sac-fry tissue. To scale that concentration to a whole body concentration for warm water fish, a factor of 0.5 was applied, based on site-specific and literature reports indicating that egg PCB concentrations are higher than the maternal whole body tissue concentration. As a result, USEPA (2004b) selected a whole body tissue concentration of 31 mg/kg ww as the CBR protective of reproductive and developmental endpoints for warmwater fish species. That CBR is also used in this analysis.

4.3.2 Toxicity Reference Value Derivation

A variety of approaches are available for deriving TRVs, including regression analyses, toxicity testing, application of extrapolation and uncertainty factors, probabilistic analyses, and others. For this evaluation, TRVs were derived for bird and mammal ROIs from laboratory study results, based on the methodology of Sample et al. (1996). This process involves the determination of a test species dose for a critical endpoint. The TRVs used in this SLERA for avian and mammalian ROIs are shown in Table 18.

As a first step in TRV derivation, the available primary and secondary literature was first reviewed, with the objective of identifying the most appropriate underlying study or studies (i.e., the critical study). Study quality and appropriateness were judged based on:

- Type of endpoint (order of preference: reproduction or development > survival > other);
- Identity of the test species used in the study (ROI > closely related wildlife species > less closely related wildlife species > domesticated species);
- Effects level of a study (no observed adverse effects levels [NOAEL] > lowest observed adverse effects levels [LOAEL] > LD50 > EC50);

- Duration of the dosing period (lifetime > chronic > acute > single dose);
- Method of dosing (oral or dietary > drinking water > gavage);
- Applicability of the chemical form tested; and
- Documentation of study methods and quality control.

Toxicological values used in TRV derivation are necessarily reported in units of mg/kg-day. These units allow comparisons among organisms of different body sizes (Sample et al. 1996). Because the most appropriate mammalian toxicity study identified for PCBs expressed exposure as dietary concentrations, it was necessary to convert reported effects levels to doses, in units of mg/kg-day, as follows:

$$Dose = \frac{C \times IR}{BW}$$

where:

Dose = test species dose (mg/kg-day);
C = concentration in food (mg/kg);
IR = ingestion rate of food by the test species (kg/day); and
BW = body weight of the test species (kg).

If not specified within the study, test species ingestion rates and body weights were estimated based on data compiled by Sample et al. (1996) or USEPA (1993).

As detailed in subsequent sections, the toxicological studies of PCBs identified for both birds and mammals are chronic. Chronic studies occur over the lifetime or a majority of the lifespan of the test organism, generally longer than one year for mammals and ten weeks for birds. Additionally, studies in which the test organism is dosed during a critical life stage (e.g., gestation) are grouped with chronic duration studies. Subchronic studies include exposures of two weeks to one year for mammals or two to ten weeks for birds that do not occur during a critical life stage. Acute studies typically have exposures of less than two weeks. Because chronic studies were identified for use in this assessment, it is not necessary to apply a duration uncertainty factor to the test species dose.

Interspecies variability in sensitivity is sometimes addressed in TRV derivation through body weight scaling factors; however, this approach is not necessary for this analysis because the toxicological study identified for mink is based on mink, and because adjustment across birds species is not recommended (Sample et al. 1996).

Based on the above procedure, NOAEL and LOAEL test species doses for birds and mammals are identified in the following sections. The geometric means of the NOAEL and LOAEL test species doses serve as the final TRVs for birds and mammals (Table 18), based on evolving EPA practices at Superfund sites (Greenberg and Charters 2005). According to the these authors' "Rule of Five," the geometric mean of the NOAEL and LOAEL values is considered adequately protective of organisms and serves as the underlying basis for ecologically-based remediation goals (Greenberg and Charters 2005).

4.3.2.1 Toxicity of PCBs to Birds

No toxicity studies were identified for Aroclor 1260 in birds (Sample et al. 1996). Dahlgren et al. (1972) evaluated egg hatchability in ring-necked pheasants exposed to Aroclor 1254 for 16 weeks, at doses of 1.8 and 7.1 mg/kg-day. The higher dose reduced production and survival of offspring. At the lower PCB dose, a slight but statistically significant reduction in egg hatchability was noted during one of two trials. However, no significant effects on egg production or chick survival were observed, and the overall number of surviving chicks per hen was actually slightly higher than in the control group. Based on the overall effects on reproductive success, a NOAEL of 1.8 mg/kg-day and a LOAEL of 7.1 mg/kg-day is calculated. Thus, the geometric mean of the NOAEL and LOAEL, 3.6 mg/kg-day, serves as the TRV for birds. This study provides a conservative basis for assessing PCB-related risks to birds in this SLERA, because toxicity data for endpoints other than reproduction indicate that birds are more sensitive to Aroclor 1254 than to other Aroclors (Barron et al. 1995).

4.3.2.2 Toxicity of PCBs to Mammals

Monkeys and mink are particularly sensitive to the toxicological effects of PCBs (ATSDR 1993). Reproductive effects commonly observed include decreased fertility, decreased conception, prolonged menstruation, and partial or total reproductive inhibition. Other sensitive endpoints are those involving neurobehavioral functions and neurodevelopment (ATSDR 1993; WHO 1992).

No toxicity studies were identified for Aroclor 1260 in mammals (Sample et al. 1996). However, two chronic reproductive studies were identified for Aroclor 1254, and one of these studies evaluated the chronic toxicity of Aroclor 1254 in tests using mink. Aulerich and Ringer (1977) administered 1254 *via* diet to mink over a 4.5 month period. Sample et al. (1996) calculated a NOAEL of 0.14 mg/kg-day and a LOAEL of 0.69 mg/kg-day from the Aulerich and Ringer (1977) study. The geometric mean of the NOAEL and LOAEL, 0.31 mg/kg-day, serves as the TRV for mink. Because mink are especially sensitive to PCBs, this value overestimates the sensitivity of other mammalian species that are more likely to be present in the Off-Property Area.

4.4 Refined Evaluation of Risk Estimates

To estimate ecological risks to fish, HQs are calculated as the ratio of the fish tissue concentration to the CBR:

$$HQ = \frac{Cf}{CBR}$$

where:

HQ = hazard quotient (unitless);
Cf = concentration of COPEC in whole fish (mg/kg); and
CBR = critical body residue (mg/kg).

To estimate ecological risks to avian and mammalian ROIs, HQs are calculated for each ROI. A wildlife HQ is the ratio of the TDI to the TRV:

$$HQ = \frac{TDI}{TRV}$$

where:

HQ = hazard quotient (unitless);
TDI = total daily intake (mg/kg body weight-day); and
TRV = toxicity reference value (mg/kg body weight-day).

As in Step 2 of the SLERA, HQ values equal to or less than one indicate that ecological risk is negligible, while HQ values greater than one suggest that ecological risk is possible, contingent on the degree of certainty in the variables and methods used to calculate the HQ. Although HQ values much greater than one can be assumed to describe risks that are more severe than those associated with HQs that slightly exceed one, HQ values should not be interpreted literally or as probabilities. For example, an HQ of 0.5 does not reflect a 50 percent probability of adverse effects and an HQ of 4 does not necessarily indicate adverse effects twice as severe as those associated with an HQ of 2.

The HQ for fish, based on the maximum fish tissue concentration of 6.2 mg/kg and the CBR of 31 mg/kg, is equal to 0.2. Based on the mean fish tissue concentration of 2.2 mg/kg, the HQ is equal to 0.07. Therefore, risks to fish in the Off-Property Area are negligible, as was also predicted based on the sediment PRG for PCBs. Table 19 summarizes HQs for each bird and wildlife ROI. The HQ for mink, based on the maximum EPC, is equal to one, while the HQs for belted kingfisher, great blue heron, and red-tailed hawk are less than one. Therefore, risks to birds and mammals in the Off-Property Area are expected to be negligible. Thus, no further evaluation of these ROIs is warranted.

4.4.1 Refined Evaluation of Uncertainty

Characterization of uncertainty is the final component of the ERA process (USEPA 1997). This section provides a narrative discussion of the types of uncertainties that may influence the refined SLERA results. As previously noted, uncertainty in ERA represents "the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard, or of its spatial and temporal distribution" (USEPA 1997). This refined analysis generally addresses uncertainty through the use of conservative assumptions, such that PCB-related risks to wildlife are much more likely to be overestimated than underestimated.

The uncertainties associated with key parameters are summarized below.

- *Maximum concentrations* – The use of maximum chemical concentrations in the initial tier of the screening evaluation is simplistic and highly conservative. Because many invertebrates and all vertebrates are mobile, most ecological receptors are actually exposed to a range of concentrations over time as they move throughout their foraging range. Nonetheless, maximum concentrations are applied in Step 2 of the SLERA to account for the possibility that the true range of chemical concentrations may not have been fully characterized by the often limited sampling designs employed at the screening level stage.
- *Screening values* – The SESLs used to characterize effects are selected conservatively, in that the minimum value available is employed even if alternative values are more applicable or have a stronger scientific basis.
- *Estimation of small mammal tissue concentrations* – In the absence of measured concentrations of PCBs in small mammals, it was necessary to estimate those concentrations using a soil-to-small mammal uptake factor. Estimated concentrations in biota tissue are inherently less certain than measured concentrations. However, the uptake factor was based on a robust study (Efroymson et al. 1997; Sample et al. 1997) and was multiplied by both maximum and mean soil concentrations from the Off-

Property Area, in order to fully characterize the expected range of small mammal tissue concentrations. Use of the maximum concentration likely overestimates exposure of PCBs to small mammals within the Off-Property Area.

- *Food ingestion rates*: Food ingestion rates used in this SLERA were selected from available studies reviewed by USEPA (1993). Efforts were made to select values that best represented the characteristics of the wildlife populations at the Off-Property Area, with respect to age, location, and gender.
- *Area use factors*: Great blue herons, red-tailed hawks, and mink were assumed to obtain 50 percent of their diet outside the study area. Given the limited size of the Off-Property Area and these species expansive foraging ranges, this is a reasonable assumption for the one or two individuals that may be present. On a population scale, this assumption is quite conservative. Thus the area use factors employed in this SLERA are conservative, leading to a significant overestimation of potential risks.
- *Absorption rates*: Absorption rates are set at the maximum possible level (100 percent) and likely overestimate absorption of PCBs from the diet.

Overall, the likelihood of underestimating risks in this SLERA is low. The SLERA uses a combination of conservative and central tendency estimates for the exposure assessment and conservative estimates for the effects assessment. This approach very likely results in a overestimation of potential risks to birds and mammals.

4.5 Scientific Management Decision Point

According to USEPA (2000) guidance, it is appropriate to consider the need for further evaluation of the potential ecological risks at a site after completing an ecological risk screening evaluation (i.e., at the conclusion of Step 3a). At this SMDP, it is useful to reiterate and integrate the critical findings of the SLERA in a manner that allows for informed risk management. Generally, the following types of decisions are considered at the SMDPs (USEPA 1997, 2000):

- Whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for any further action on the basis of ecological risk.
- Whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process will continue.
- Whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment or remediation is warranted.

The information available for the MEW Property is sufficient to conclude that adverse ecological risks are negligible and, therefore, there is no need for further action on the basis of ecological risks. The critical points underlying this SMDP are also provided below.

ACOE Channel

The ACOE channel was constructed for runoff and flood control purposes. It is approximately 3.6 acres in area and is located south of the wet meadow and retention pond. It is located within a wetland area, as defined by the ACOE (1987, 1992) Wetlands Delineation Manual. The ACOE channel is within an area zoned for light and heavy industrial land use. The channel's maintenance (i.e., channelization and vegetation removal), as well as its narrow width and shallow depth, limit this area as suitable habitat for sustaining substantial populations of ecological receptors. To support the evaluation of potential ecological risks, sediment, surface water, benthic macroinvertebrate, and fish tissue samples were collected by Komex at locations along the ACOE channel.

In Step 2 of the SLERA, screening level HQ values, based on maximum chemical concentrations and conservative screening criteria, exceeded one for several chemicals in sediment and surface water from the channel. However, the refined screening evaluation identified only Aroclor 1260 in sediment and fish tissue as a COPEC warranting further evaluation relative to fish and upper trophic level wildlife.

Step 3a of the SLERA considered the effects of Aroclor 1260 in ACOE channel fish tissue to the fish themselves, as well as to aquatic-feeding wildlife. All fish and wildlife HQs were one or less and were based on consistently conservative assumptions. Thus, concentrations of Aroclor 1260 in sediment and fish tissue within the ACOE channel are not adversely affecting fish or wildlife populations. Therefore, further consideration of ecological risks is not warranted for the ACOE channel.

Retention Pond

A man-made retention pond covering approximately 1.4 acres lies along part of the southern border of the wet meadow, adjacent to the ACOE channel. The pond is about 4 feet deep in the center and is within an area zoned for light and heavy industrial land use. The retention pond's narrow riparian margin, man-made features, small size, and shallow depth substantially limit this area as suitable habitat for sustaining populations of ecological receptors. To support the evaluation of potential ecological risks, Komex collected sediment, surface water, benthic macroinvertebrate, and fish tissue samples from the retention pond.

In Step 2 of the SLERA, screening level HQ values, based on maximum chemical concentrations and conservative screening criteria, exceeded one for two chemicals in sediment (Aroclor 1260 and acetone) and one chemical in surface water (BEHP). However, a refined screening evaluation identified only Aroclor 1260 in sediment and fish tissue as a COPEC warranting further evaluation relative to fish and upper trophic level wildlife.

Step 3a of the SLERA considered the effects of Aroclor 1260 in retention pond sediment and fish tissue to the fish themselves, as well as to aquatic-feeding wildlife. All fish and wildlife HQs were one or less and were based on consistently conservative assumptions. Thus, concentrations of Aroclor 1260 in sediment and fish tissue within the retention pond are not adversely affecting fish or wildlife populations. Therefore, further consideration of ecological risks is not warranted for the retention pond.

Drainage Ditch along Wilson Road

Surface water runoff from the MEW Property collects in a drainage ditch just south of and parallel to Wilson Road, and along the northern boundary of the wet meadow. The portion of the drainage ditch that runs along Wilson Road is regularly maintained to facilitate surface water flow and is within an area zoned for light and heavy industrial land use. The drainage ditch's man-made features, vegetation removal, narrow width, and shallow depth substantially limit this area as suitable habitat for sustaining populations of ecological receptors. To support the evaluation of potential ecological risks, Komex collected sediment, surface soil, and surface water samples along the drainage ditch.

In Step 2 of the SLERA, screening level HQ values, based on maximum chemical concentrations and conservative screening criteria, exceeded one for two chemicals in sediment (Aroclor 1260 and acetone), one chemical in surface soil (Aroclor 1260), and one chemical in surface water (BEHP). However, a refined screening evaluation identified only Aroclor 1260 in sediment and surface soil as a COPEC warranting further evaluation relative to upper trophic level wildlife.

In Step 3a of the SLERA, the effects of Aroclor 1260 in drainage ditch sediment to aquatic-feeding wildlife and in ditch surface soil to terrestrial-feeding wildlife were considered. All wildlife HQs were one or less and were based on consistently conservative assumptions. Thus, concentrations of Aroclor 1260 in sediment and surface soil within the drainage ditch are not adversely affecting wildlife populations. Therefore, further consideration of ecological risks is not warranted for the drainage ditch.

Wet Meadow

The wet meadow area lies between Wilson Road and the ACOE channel, covering approximately 20 acres. The eastern portion of the wet meadow is zoned for light industrial use, while the western portion is zoned for heavy industrial land use. The meadow is regularly mowed, and the western portion was cleared of all trees and other large brush in 2004. Property owners are actively seeking to develop the western portion of the wet meadow. Vegetation removal (trees, brush, and regular mowing), repeated draining, and the addition of fill limit this area as suitable habitat for sustaining populations of ecological receptors. To support the evaluation of potential ecological risks, surface soil and surface water samples were collected by Komex at locations within the wet meadow.

In Step 2 of the SLERA, screening level HQ values, based on maximum chemical concentrations and conservative screening criteria, exceeded one for Aroclor 1260 in soil. No chemicals were detected in standing water collected from the wet meadow. The refined screening evaluation retained Aroclor 1260 in surface soil as a COPEC warranting further evaluation relative to upper trophic level wildlife.

In Step 3a of the SLERA, the effects of Aroclor 1260 in wet meadow surface soil to terrestrial-feeding wildlife was considered. All wildlife HQs were one or less and were based on consistently conservative assumptions. Thus, concentrations of Aroclor 1260 in surface soil within the wet meadow are not adversely affecting wildlife populations. Therefore, further consideration of ecological risks is not warranted for the wet meadow.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Previous studies conducted on behalf of MDNR and USEPA Region VII identified the presence of Aroclor 1260 (a mixture of PCBs) and other chemicals on the MEW Property and downgradient areas (EarthTech 1990). The presence of these chemicals at the MEW Property likely resulted from historical operations, including handling and storage of PCB-containing transformer fluids (EarthTech 1990). Overland runoff from the MEW Property may have contributed to the presence of PCBs in the downgradient Off-Property Area (EarthTech 1990), although other sources of PCBs may also exist.

The entire area in the immediate vicinity of the MEW Property, including Off-Property Area, is zoned for industrial land use. Furthermore, the MDOC has not identified records of any species or habitats with either Federal or State restrictions within a one-mile radius of the MEW Property (MDOC 2005).

Soil remediation activities (i.e., excavation and thermal desorption) were conducted at the MEW Property in 1999 and 2000. Source removal at the MEW Property was completed in September 2000 and has effectively eliminated off-site transport of PCBs from soils at the MEW Property (Komex 2001c, 2003c). Nonetheless, some residual off-site contamination may have resulted from historical overland runoff from the MEW Property.

In order to screen potential ecological risks in the Off-Property Area, this SLERA follows a conservative approach, whereby maximum detected chemical concentrations in sediment, surface soil, and surface water were initially compared to conservative screening benchmarks. Chemicals not eliminated following the initial tier of screening were evaluated further, based on more accurate site-specific, and chemical-specific information. Aroclor 1260 in fish tissue, sediment, and surface soil was the only COPEC identified as warranting further evaluation.

Because the refined COPEC selection eliminated the potential for significant ecological risks to invertebrates, the potential risk posed by PCBs to fish and aquatic- and terrestrial-feeding wildlife was evaluated. ROIs included fish, belted kingfishers, great blue herons, red-tailed hawks, and mink. Although maximum chemical concentrations in sediment, surface soil, and fish tissue and other conservative assumptions were considered, risks to fish, birds, and mammals proved to be negligible (i.e., all HQs were equal to or less than one).

In conclusion, environmental samples collected from the Off-Property Area do not indicate that historical releases from the MEW Property are adversely affecting local populations of ecological receptors. Given these findings, as well as the area's industrial zoning and the lack of any identified species or habitats with either Federal or State restrictions, further ecological evaluation of this area is not recommended.

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TABLES

Table 1
Sampling Conducted at Individual Locations
MISSOURI ELECTRIC WORKS

Sampling Location	Surface Water	Soil	Sediment	Benthic Macro-invertebrates
ACOE Channel				
A	X	--	X	X
B	X	--	X	X
C	X	--	X	X
Retention Pond				
D1	X	--	X	X
D2	X	--	X	X
D3	X	--	X	X
Drainage Ditch				
E	--	X	--	--
F	--	X	--	--
G	X	X	X	--
H	X	X	X	--
Wet Meadow				
I1	--	X	--	--
I2	--	X	--	--

Notes:
X = Samples collected for analysis.
-- = No samples collected.

TABLE 2
ANALYTICAL RESULTS FOR CHEMICAL CONSTITUENTS DETECTED IN SEDIMENT
MISSOURI ELECTRIC WORKS

	SEDIMENT SAMPLE LOCATIONS													
CHEMICAL NAME	**A-0**	**B-0**	**C-0**	**D1-1**	**D1-2**	**D1-3**	**D2-1**	**D2-2**	**D2-3**	**D3-1**	**D3-2**	**D3-3**	**G-0**	**H-0**	**H-0 (Dup)**
2-Butanone (MEK)	**110**	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Acetone	**78**	**83**	**90**	**250**	**170**	**190**	< 36	**110**	**95**	**180**	**230**	**300**	**49**	< 22	**23**
Aroclor-1260	**260**	**950**	**180**	**260**	**150**	**200**	**170**	**160**	**150**	**140**	**120**	**130**	**1100**	**66**	**25** J
Benzene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**1.8** J	< 5.5	< 5.2
Benzo(a)anthracene	< 2900	< 4300	**620** J	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzo(b)fluoranthene	< 2900	< 4300	**960** J	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Chrysene	< 2900	< 4300	**700** J	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Ethylbenzene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**2.7** J	< 5.5	< 5.2
Fluoranthene	< 2900	< 4300	**780** J	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Methylcylohexane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**17**	**2** J	**1.9** J
m,p-Xylene	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	**10**	< 11	< 10
o-Xylene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**3.5** J	< 5.5	< 5.2
Pyrene	< 2900	< 4300	**930** J	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Toluene	**2.2** J	**1.8** J	**21**	< 18	< 11	< 14	< 9.1	**3.8** J	< 8.3	< 12	< 13	**4.4** J	**15**	**1.8** J	**1.6** J
Percent Moisture	43.4	62	38.2	61.4	60.8	58.7	53.9	46.7	50.5	60.7	61.7	65.5	17.2	22.2	23.1

Notes:
1- All values are expressed in micrograms per kilogram except moisture (percentage).
2- < : compound not detected at stated reporting limit
3- J flag represents a value detected below laboratory reporting limit.
4- "Dup" refers to a duplicate sample.

TABLE 3
ANALYTICAL RESULTS FOR CHEMICAL CONSTITUENTS DETECTED IN SOIL
MISSOURI ELECTRIC WORKS

CHEMICAL NAME	SOIL SAMPLE LOCATIONS																			
	E2-0	E2-3	E2-5	F-0	F-3	F-5	G-0	G-3	G-5	H-0	H-3	H-5	I1-0	I1-3	I1-5	I2-0	I2-3	I2-5	I2-0 (Dup)	I2-3 (Dup)
2-Butanone (MEK)	< 11	< 10	< 10	**17**	**32**	< 8.5	**34**	< 9.4	< 8.0	< 12	< 8.7	< 8.7	**29**	< 8.2	< 9.0	< 12	**22**	< 10	< 9.6	**18**
Acetone	**95**	**100**	< 20	**220**	**210**	**150**	**150**	**39**	**37**	< 25	< 17	< 17	**370**	< 16	**95**	**190**	**200**	**67**	**73**	**150**
Aroclor-1260	**1800**	**4000**	**610**	**1800**	**36** J	< 42	**4400**	**720**	**1000**	**120**	**30** J	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Benzene	**4.1** J	**1.3** J	< 5.1	**2.1** J	< 4.7	< 4.3	**2.9** J	**2.1** J	< 4.0	**2.2** J	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Benzo(a)anthracene	< 430	< 430	< 410	< 400	< 410	< 410	**170** J	< 390	< 400	**120** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(a)pyrene	< 430	< 430	< 410	< 400	< 410	< 410	**300** J	< 390	< 400	**160** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(b)fluoranthene	< 430	< 430	< 410	< 400	< 410	< 410	**380** J	< 390	< 400	**230** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Chrysene	< 430	< 430	< 410	< 400	< 410	< 410	**280** J	< 390	< 400	**170** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Ethylbenzene	< 5.4	< 5.2	< 5.1	**1.5** J	< 4.7	< 4.3	**4.4** J	**4.4** J	**0.85** J	**4.4** J	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Fluoranthene	< 430	< 430	< 410	< 400	< 410	< 410	**520**	**52** J	< 400	**290** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
m,p-Xylene	< 11	< 10	< 10	**5.6** J	< 9.4	< 8.5	**17**	**18**	**3.2** J	**16**	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
Methylcylohexane	**6.7**	< 5.2	< 5.1	**10**	< 4.7	< 4.3	**30**	**19**	**5.6**	**27**	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
o-Xylene	< 5.4	< 5.2	< 5.1	**1.9** J	< 4.7	< 4.3	**5.9**	**6.4**	**1.1** J	**5.8** J	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Phenanthrene	< 430	< 430	< 410	< 400	< 410	< 410	**230** J	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Pyrene	< 430	< 430	< 410	< 400	< 410	< 410	**340** J	< 390	< 400	**200** J	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Toluene	**2.2** J	**2.1** J	< 5.1	**7.8**	**1.2** J	< 4.3	**22**	**19**	**4.5**	**20**	< 4.3	< 4.4	**1.4** J	**1** J	**1.6** J	< 6.0	< 5.4	< 5.1	< 4.8	**1.1** J
Percent Moisture (%)	24	23.3	20	16.7	19.8	20	28.7	15.8	18.2	30.6	21.5	18.9	12.6	20.1	23.9	10.7	21.6	21	20.8	19.1

Notes:
1- All values are expressed in micrograms per kilogram except moisture (percentage).
2- < : compound not detected at stated reporting limit
3- J flag represents a value detected below laboratory reporting limit.
4- "Dup" refers to a duplicate sample.

TABLE 4
ANALYTICAL RESULTS FOR CHEMICAL CONSTITUENTS DETECTED IN SURFACE WATER
MISSOURI ELECTRIC WORKS

CHEMICAL NAME	SURFACE WATER SAMPLE LOCATIONS								
	A	B	C	D1	D2	D3	G	H	H-DUP
1,1,1-Trichloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**3.7 J**	<5.0	<5.0
Bis(2-ethylhexyl)phthalate	<10	**3.2 JH**	<10	<10	**8.8 J**	**1.8 J**	**4.9 J**	**2.6 J**	**2.8 J**
Carbon Disulfide	**5.3**	**5.5**	**18**	**3.9 J**	**2.6 J**	<5.0	<5.0	**4.9 J**	**2.6 J**
Chloroform	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**2.3 J**	<5.0	<5.0
Chloromethane	<5.0	<5.0	<5.0	<5.0	<5.0	**3.1 J**	<5.0	<5.0	<5.0

Notes:

1- All values are expressed in micrograms per liter.

2- < : compound not detected at stated reporting limit

3- J flag represents a value detected below laboratory reporting limit.

4- H flag represents that the holding times for preparation or analysis were exceeded.

TABLE 5
WATER QUALITY PARAMETERS AND RESULTS
MISSOURI ELECTRIC WORKS

SAMPLE LOCATION	DATE	TIME	WATER DEPTH (inches)	pH	TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/L)	CONDUCTIVITY (mS/cm)	TURBIDITY (NTU)	SALINITY (%)
A	08/15/03	10:30	6-18	7.37	28.8	2.16	0.250	0	0.01
B	08/12/03	15:30	6-18	7.37	27.2	1.34	0.379	0	0.01
C	08/14/03	16:57	6-18	7.17	25.2	1.45	0.356	33	0.01
D1	08/15/03	10:45	54	7.35	27.5	3.05	0.251	0	0.00
D2	08/15/03	11:30	63	7.40	27.4	3.61	0.250	0	0.00
D3	08/15/03	12:05	75	7.49	27.1	2.40	0.242	0	0.00
G	08/14/03	11:40	8	7.76	24.0	6.30	0.484	96	0.02
H	08/15/03	15:39	12-16	7.94	26.9	5.85	0.439	481	0.01

Notes:

1- Surface water was not encountered at the following locations: E1, E2, F, I1 and I2. Consequently no water quality parameters are listed for these locations.

2- mg/L = milligrams per liter

3- mS/cm = milliSiemens per centimeter

4- NTU = Nephelometric Turbidity Units

5- °C = degrees Celsius

TABLE 6
Maximum Detected Concentrations in Nearby Property Media
MISSOURI ELECTRIC WORKS

CHEMICAL NAME	ACOE Channel		Retention Pond		Drainage Ditch		Wet Meadow	
	Maximum Concentration	Sampling Location	Maximum Concentration	Sampling Location	Maximum Concentration	Sampling Location	Maximum Concentration	Sampling Location
Sediment								
1,2-Benzphenanthracene	700 J	C	ND	NA	ND	NA	–	–
2-Butanone (MEK)	110	A	ND	NA	ND	NA	–	–
Acetone[b]	90	C	300	D3	49	G	–	–
Aroclor-1260	950	B	260	D1	1100	G	–	–
Benzene	ND	NA	ND	NA	1.8 J	G	–	–
Benzo(a)anthracene	620 J	C	ND	NA	ND	NA	–	–
Benzo(b)fluoranthene	960 J	C	ND	NA	ND	NA	–	–
Ethylbenzene	ND	NA	ND	NA	2.7 J	G	–	–
Fluoranthene	780 J	C	ND	NA	ND	NA	–	–
m,p-Xylene	ND	NA	ND	NA	10	G	–	–
Methylcyclohexane	ND	NA	ND	NA	17	G	–	–
o-Xylene	ND	NA	ND	NA	3.5 J	G	–	–
Pyrene	930 J	C	ND	NA	ND	NA	–	–
Toluene	21	C	4.4 J	D3	15	G	–	–
Soil								
1,2-Benzphenanthracene	–	–	–	–	280 J	G	ND	NA
2-Butanone (MEK)	–	–	–	–	34	G	29	I1
Acetone	–	–	–	–	220	F	370	I1
Aroclor-1260	–	–	–	–	4400	G	ND	NA
Benzene	–	–	–	–	4.1 J	E2	ND	NA
Benzo(a)anthracene	–	–	–	–	170 J	G	ND	NA
Benzo(a)pyrene	–	–	–	–	300 J	G	ND	NA
Benzo(b)fluoranthene	–	–	–	–	380 J	G	ND	NA
Ethylbenzene[c]	–	–	–	–	4.4 J	G, H[d]	ND	NA
Fluoranthene	–	–	–	–	520	G	ND	NA
m,p-Xylene[b]	–	–	–	–	18	G[b]	ND	NA
Methylcyclohexane	–	–	–	–	30	G	ND	NA
o-Xylene[b]	–	–	–	–	6.4	G[b]	ND	NA
Phenanthrene	–	–	–	–	230 J	G	ND	NA
Pyrene	–	–	–	–	340 J	G	ND	NA
Toluene	–	–	–	–	22	G	1.6 J	I1[c]
Surface Water								
1,1,1-Trichloroethane	ND	NA	ND	NA	3.7 J	G	ND	NA
Bis(2-ethylhexyl)phthalate	3.2 J	B[e]	8.8 J	D2	4.9 J	G	ND	NA
Carbon Disulfide	18	C	3.9 J	D1	4.9 J	H	ND	NA
Chloroform	ND	NA	ND	NA	2.3 J	G	ND	NA
Chloromethane	ND	NA	3.1 J	D3	ND	NA	ND	NA

Notes:
– = Not Sampled
NA = Not Applicable
ND = Not Detected
J = value detected below laboratory reporting limit

[a] All samples were detected at the surface (at a depth of 0 feet) unless otherwise noted.
[b] Detected at a depth of 3 feet.
[c] Detected at a depth of 5 feet.
[d] Detected at Location G at depths of 0 and 3 feet and Location H at depths of 0 feet.
[e] Holding time was exceeded.
[f] Sampling Location not identified.

CONTAMINANTS OF ECOLOGICAL CONCERN	Units	NOAA[a]		USEPA SEDIMENT QUALITY VALUE[b]	ORNL PRG	USEPA Region 4 ECOLOGICAL SCREENING LEVELS[d]	USEPA Region 5 ECOLOGICAL SCREENING LEVELS[e]	USEPA Region 6 ECOLOGICAL SCREENING LEVELS - TRVs[f]
		CMC/TEL	CCC/PEL					
1,1,1-Trichloroethane								
Surface Water	µg/L	18000	--	--	11	528	76	--
Soil	µg/kg	--	--	--	--	--	29800	--
Sediment	µg/kg	--	--	170	9600	--	213	--
2-Butanone (MEK)								
Surface Water	µg/L	--	--	--	14000	--	2200	--
Soil	µg/kg	--	--	--	--	--	89600	--
Sediment	µg/kg	--	--	--	270	--	42.4	--
Acetone								
Surface Water	µg/L	--	--	--	1500	--	1700	1500
Soil	µg/kg	--	--	--	--	--	2500	--
Sediment	µg/kg	--	--	--	9.1	--	9.9	57.1
Aroclor 1260								
Surface Water	µg/L	--	--	--	94	0.014[h]	--	--
Soil	µg/kg	--	--	--	--	--	--	--
Sediment	µg/kg	--	--	--	63000	--	--	--
Benzene								
Surface Water	µg/L	5300	--	--	130	53[h]	114	--
Soil	µg/kg	--	--	--	--	50	255	--
Sediment	µg/kg		--	57	160	--	142	--
Benzo(a)anthracene								
Surface Water	µg/L	300[g]	--	--	0.027	--	0.025	0.027
Soil	µg/kg	--	--	--	--	--	5210	--
Sediment	µg/kg	31.7	385	--	690	330	108	19
Benzo(a)pyrene								
Surface Water	µg/L	300[g]	--	--	0.014	--	0.014	0.014
Soil	µg/kg	--	--	--	--	100	1520	--
Sediment	µg/kg	31.9	782	--	394	330	150	84
Benzo(b)fluoranthene								
Surface Water	µg/L	300[g]	--	--	--	--	9.07	0.027
Soil	µg/kg	--	--	--	--	--	59800	--
Sediment	µg/kg	1800[j]	--	--	4000	330	10400	37
Bis(2-ethylhexyl)phthalate								
Surface Water	µg/L	400[k]	360[k]	--	0.12	<0.3[h]	0.3	30
Soil	µg/kg	--	--	--	--	--	925	--
Sediment	µg/kg	750[c]	2646.51[c]	--	2700	182	182	13300
Carbon Disulfide								
Surface Water	µg/L	--	--	--	0.92	--	15	--
Soil	µg/kg	--	--	--	--	--	94.1	--
Sediment	µg/kg	--	--	--	0.86	--	23.9	--
Chloroform								
Surface Water	µg/L	28900	1240	--	28	289	140	28
Soil	µg/kg	--	--	--	--	1	1190	--
Sediment	µg/kg	--	--	--	960	--	121	59.4
Chloromethane								
Surface Water	µg/L	--	--	--	--	5500	--	--
Soil	µg/kg	--	--	--	--	--	10400	--
Sediment	µg/kg	--	--	--	--	--	--	--
Chrysene								
Surface Water	µg/L	300[g]	--	--	--	--	--	0.027
Soil	µg/kg	--	--	--	--	--	4730	--
Sediment	µg/kg	57.1	862	--	850	330	166	30
Ethylbenzene								
Surface Water	µg/L	32000	--	--	7.3	453[h]	14	--
Soil	µg/kg	--	--	--	--	50	5160	--
Sediment	µg/kg	4[i]	--	3600	5400	--	175	--
Fluoranthene								
Surface Water	µg/L	3980	16[g]	--	6.2	39.8[h]	1.9	--
Soil	µg/kg	--	--	--	--	100	122000	--
Sediment	µg/kg	111	2355	2900*	834	330	423	--
m,p-xylene/o-xylene/Xylene (total)								
Surface Water	µg/L	--	--	--	13	--	27	--
Soil	µg/kg	--	--	--	--	50	10000	--
Sediment	µg/kg	4[i]	--	25[j]	160	--	433	--
Methylcyclohexane								
Surface Water	µg/L	--	--	--	--	--	--	--
Soil	µg/kg	--	--	--	--	--	--	--
Sediment	µg/kg	--	--	--	--	--	--	--
Phenanthrene								
Surface Water	µg/L	30[k]	6.3[k]	--	6.3	--	3.6	--
Soil	µg/kg	--	--	--	--	100	45700	--
Sediment	µg/kg	41.9	515	850*	540	--	204	--

TABLE 7
Ecological Screening Levels for Surface Water, Soil, and Sediment
MISSOURI ELECTRIC WORKS

CONTAMINANTS OF ECOLOGICAL CONCERN		Units	NOAA[a]		USEPA SEDIMENT QUALITY VALUE[b]	ORNL PRG	USEPA Region 4 ECOLOGICAL SCREENING LEVELS[d]	USEPA Region 5 ECOLOGICAL SCREENING LEVELS[e]	USEPA Region 6 ECOLOGICAL SCREENING LEVELS - TRVs[f]
			CMC/TEL	CCC/PEL					
Pyrene									
	Surface Water	µg/L	300[g]	--	--	--	--	0.3	--
	Soil	µg/kg	--	--	--	--	100	78500	--
	Sediment	µg/kg	53	875	--	1400	330	195	--
Toluene									
	Surface Water	µg/L	17500	5000[g]	--	9.8	175[h]	253	--
	Soil	µg/kg	--	--	--	200000	50	5450	--
	Sediment	µg/kg	--	--	670	50	--	1220	--
PCBs									
	Surface Water	µg/L	2	0.014	--	0.0019	--	0.00012	0.19[l]
	Soil	µg/kg	--	--	--	371	20	3.32E-01	--
	Sediment	µg/kg	34.1	277	--	180	33	59.8	50[l]

Notes:
-- = Not Available
µg = microgram
kg = kilogram
L = liter
mg = milligram
NOAA = National Oceanic and Atmospheric Administration
ORNL = Oak Ridge National Laboratory
PEL = Probable Effects Level
PRG = Preliminary Remediation Goals
TEL = Threshold Effects Level
TRV = Toxicity Reference Values
USEPA = United States Environmental Protection Agency

[a] Surface water values are for acute (criteria maximum concentration [CMC]) or chronic (criteria continuous concentration [CCC]) exposures. Sediment values are for freshwater sediment and are either the TEL or the PEL. The TEL is calculated as the geometric mean of the 15th percentile concentration of the toxic effects data set and the median of the no-effect data set; and is intended to represent the concentration below which adverse effects are expected to occur only rarely. The PEL, on the other hand, is the geometric mean of the 50% of impacted toxic samples and 85% of the non-impacted samples, and represents the level above which adverse effects can be expected (NOAA 1999). Soil values are not recommended.
[b] Values listed are USEPA Sediment Quality Benchmarks unless otherwise noted by a star (*). If noted, the listed value is a USEPA Sediment Quality Criteria. Both quality guidelines assumes 1 percent organic carbon (USEPA 1996).
[c] in the absences of a TEL, a Upper Effects Threshold (UET) was listed. This value is on a dry weight basis. The PEL listed is for marine sediment.
[d] Simon (2000)
[e] USEPA (2003)
[f] USEPA (1999)
[g] Value listed is for marine surface water.
[h] Values listed are for chronic exposure. Acute values can be calculated by multipling the chronic number by a factor of 10, with the exception of Aroclor 1260 and Bis(2-ethylhexyl)phthalate (acute screening value = 0.2 ug/L, 1110 ug/L, respectively).
[i] In the absence of a TEL or a PEL, the value listed is an Apparent Effects Level.
[j] Value listed is for m-xylene.
[k] Value listed is proposed.
[l] Value listed is for Aroclor 1254 and 1016. This value has been adopted from USEPA (1996) value for total PCBs.

Sources:
Simon, T.W. 2000. Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders. Memorandum. United States Environmental Protection Agency. June 23.
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Oak Ridge National Laboratory (ORNL). 1997. Preliminary Remediation Goals for Ecological Endpoints. ES/ER/TM-162/R2. U.S. Department of Energy. August.
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United States Environmental Protection Agency (USEPA). 2003. Ecological Screening Levels (ESLs). Region 5, Resource Conseservation and Recovery Act (RCRA). [online]. Available: http://risk.lsd.ornl.gov/ports/eco/ESL.pdf. Accessed: November 30, 2004.

TABLE 8
Step 2 - Hazard Quotients by Site Subarea
MISSOURI ELECTRIC WORKS

CHEMICAL NAME	Maximum Detected Concentration				SESL	Hazard Quotient			
	ACOE Channel	Retention Pond	Drainage Ditch	Wet Meadow		ACOE Channel	Retention Pond	Drainage Ditch	Wet Meadow
Sediment (ug/kg)									
2-Butanone (MEK)	110	ND	ND	–	42.4 [a]	2.6	ND	ND	–
Acetone	90	300	49	–	9.9 [a]	9.1	30.3	4.9	–
Aroclor-1260	950	260	1100	–	59.8 [a,b]	16	4.3	18	–
Benzene	ND	ND	1.8	–	142 [a]	ND	ND	0.01	–
Benzo(a)anthracene	620	ND	ND	–	108 [a]	5.7	ND	ND	–
Benzo(b)fluoranthene	960	ND	ND	–	10400 [a]	0.1	ND	ND	–
Chrysene	700	ND	ND	–	166 [a]	4.2	ND	ND	–
Ethylbenzene	ND	ND	2.7	–	175 [a]	ND	ND	0.02	–
Fluoranthene	780	ND	ND	–	423 [a]	1.8	ND	ND	–
m,p-Xylene	ND	ND	10	–	433 [a]	ND	ND	0.02	–
Methylcylohexane	ND	ND	17	–	NA [c]	ND	ND	NA	–
o-Xylene	ND	ND	3.5	–	433 [a]	ND	ND	0.01	–
Pyrene	930	ND	ND	–	195 [a]	4.8	ND	ND	–
Toluene	21	4.4	15	–	1220 [a]	0.02	0.004	0.01	–
Soil (ug/kg)									
2-Butanone (MEK)	–	–	34	29	89600 [a]	–	–	0.0004	0.0003
Acetone	–	–	220	370	2500 [a]	–	–	0.09	0.15
Aroclor-1260	–	–	4400	ND	0.33 [a,b]	–	–	1.3E+04	ND
Benzene	–	–	4.1	ND	255 [a]	–	–	0.02	ND
Benzo(a)anthracene	–	–	170	ND	5210 [a]	–	–	0.03	ND
Benzo(a)pyrene	–	–	300	ND	1520 [a]	–	–	0.20	ND
Benzo(b)fluoranthene	–	–	380	ND	59800 [a]	–	–	0.01	ND
Chrysene	–	–	280	ND	4730 [a]	–	–	0.06	ND
Ethylbenzene	–	–	4.4	ND	5160 [a]	–	–	0.001	ND
Fluoranthene	–	–	520	ND	122000 [a]	–	–	0.004	ND
m,p-Xylene	–	–	18	ND	10000 [a]	–	–	0.002	ND
Methylcylohexane	–	–	30	ND	NA [c]	–	–	NA	ND
o-Xylene	–	–	6.4	ND	10000 [a]	–	–	0.001	ND
Phenanthrene	–	–	230	ND	45700 [a]	–	–	0.01	ND
Pyrene	–	–	340	ND	78500 [a]	–	–	0.004	ND
Toluene	–	–	22	1.6	5450 [a]	–	–	0.004	0.0003

TABLE 8
Step 2 - Hazard Quotients by Site Subarea
MISSOURI ELECTRIC WORKS

CHEMICAL NAME	Maximum Detected Concentration				SESL		Hazard Quotient			
	ACOE Channel	Retention Pond	Drainage Ditch	Wet Meadow			ACOE Channel	Retention Pond	Drainage Ditch	Wet Meadow
Surface Water (ug/L)										
1,1,1-Trichloroethane	ND	ND	3.7	ND	76	a	ND	ND	0.05	ND
Bis(2-ethylhexyl)phthalate	3.2	8.8	4.9	ND	0.3	a	11	29	20	ND
Carbon Disulfide	18	3.9	4.9	ND	15	a	1	0.3	0.33	ND
Chloroform	ND	ND	2.3	ND	140	a	ND	ND	0.02	ND
Chloromethane	ND	3.1	ND	ND	5500	d	ND	0.001	ND	ND

Notes:
-- = Not Sampled
NA = Not Available
ND = Not Detected
[a] USEPA 2003
[b] In the absense of a screening benchmarks for Aroclor 1260 in USEPA (2003), the value for total polychlorinated biphenyls was used.
[c] Screening Level unavailable.
[d] Simon 2000

Sources:

Simon, T.W. 2000. Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders. Memorandum. United States Environmental Protection Agency. June 23.

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Source of Uncertainty	SLERA Management Approach	Effect on SLERA Results
	Analytical Sampling and Data Analysis	
Limited number of samples - biased sampling	Typically, only a limited number of samples are used in ERAs, and very often they are collected in a biased manner (i.e., targeting "hot spots"). This type of sampling often lacks statistical power and does not likely represent the concentrations in the environment in which wildlife exposure occurs.	Overestimate of exposure and risk
Use of maximum concentrations	The use of the maximum detected concentrations overestimates exposure and risk.	Overestimate of exposure and risk
Non detections, with detection limits that exceed ecotoxicity screening values	There are occasions when analytical detection limits exceed ecotoxicity screening levels (ESLs). This can be due to instrument and method limitations and/or due to interference from unrelated chemicals (e.g., dilutions required to bring some other chemicals (e.g., dilutions required to bring some other chemical within a calibration range). A comparison of maximum detection limits to ESLs for the MEW Off-Property Site is provided in Table 8 for sediment, soil, and surface water.	Underestimate of exposure and risk
	Selection of Constituents of Potential Concern (COPCs)	
Background concentrations	Chemicals may be identified as COPCs despite the fact that the detected concentrations are less than background concentrations. This occurs because the ERA Process does not permit use of background until Step 3a of the BERA (USEPA 2001b).	Overestimate of exposure and risk
	Toxicology and Ecotoxicity Screening Values	
Toxicity data	Toxicity data are only available for a limited number of species (most of them laboratory test species) under a strictly defined set of test conditions that deviate from natural conditions (Sample et al. 1996; Suter 1995).	Effect on risk estimate unknown
Laboratory toxicity testing	Simplistic extrapolations from laboratory species to wildlife species and testing conditions to field conditions are not likely accurate, and are rarely, if ever, validated against natural conditions (Power 1996; Tannenbaum 2003).	Overestimate of exposure and risk
Adaptation and tolerance	Consideration of bioavailability (and, thereby, diminished toxicity) tolerance and adaptation are intentionally not considered directly in a SLERA. Further, there is little consistency and no quantitative methodology for the consideration of the bioavailability (and, thereby, diminished toxicity) even though this process is well documented (e.g., Alexander 2000). Similarly, tolerance and adaptation is well documented (Millward and Klerks 2002; Grant 2000).	Overestimate of exposure and risk
	Hazard Quotients (HQs)	
HQs based on maximum concentrations	The SLERA HQ is based on the maximum detected concentrations and the most conservative ecotoxicity screening value available (USEPA 1997).	Overestimate of exposure and risk
Elevated HQs for background concentrations	HQs may exceed a value of 1 for background concentrations of naturally occurring metals (Tannenbaum 2003). This is due to many of the toxicology and ESV uncertainties already discussed. Also, background HQs greater than 1 indicate that indigenous wildlife would have adapted to these COPCs.	Overestimate of exposure and risk
Interpretation of HQs	An HQ less than or equal to a value of 1 indicates that adverse impacts to wildlife are considered unlikely (USEPA 2001b). However, there is no clear guidance for interpreting the HQs that exceed a value of 1, except that this point of departure may indicate that adverse effects of some kind may have occurred or may occur in the future.	Overestimate of exposure and risk
HQs for individual used to evaluate risks to populations	Although intentionally conservative in a SLERA, HQs are based on the types of impacts that could occur to individuals (i.e., those individuals exposed to maximum concentrations), and they completely fail to address ecological exposure and risk at spatial scale of populations (Tannenbaum 2003; Durda and Preziosi 1999).	Overestimate of exposure and risk
HQs with unrealistic magnitudes	HQs are seen at magnitudes that suggest acute toxicity. Often, conditions at a site document that this is not the case.	Overestimate of exposure and risk

Notes:

BERA	Baseline ecological risk assessment.
COPC	Constituent of potential concern.
ERA	Ecological risk assessment.
ESV	Ecotoxicity Screening Value.
HQ	Hazard quotient.
SLERA	Screening level ecological risk assessment.

TABLE 10
SUMMARY RESULTS: BENTHIC MACROINVERTEBRATES
MISSOURI ELECTRIC WORKS

SAMPLE LOCATION	SAMPLE MATRIX	ABUNDANCE	DOMINANT TAXON PERCENTAGE CONTRIBUTION	RICHNESS	TOLERANCE
A	BG	267	64	10	6.07
A	BS	289	26	28	5.85
B	BG	207	76	11	7.63
B	BS	270	54	18	6.32
C	BG	328	74	10	7.63
C	BS	381	30	27	6.41
D1	BG	83	76	4	6.95
D1	BG	90	98	3	6.99
D1	BG	104	85	6	6.92
D2	BG	42	43	5	6.86
D2	BG	28	89	4	7.04
D2	BG	63	83	4	6.98
D3	BG	170	100	1	7.00
D3	BG	70	100	1	7.00
D3	BG	102	100	1	7.00

Notes:

1- BG = Benthic Grab

2- BS = Benthic Sweep

TABLE 11
Fish Collected for Whole Body Analyses in December 2005[a]
MISSOURI ELECTRIC WORKS

Field Sample ID	Sampling Location	Collection Date	Species Collected (Common Name)	Length (cm)	Total Weight of Sample (g)	Number of Individuals in Sample
Whole Body Sample Results [a]						
BFCW	ACOE Channel (west)	12/16/2005	Mosquitofish	NR	289	≈780
FFCW	ACOE Channel (west)	12/16/2005	Bluegill + Green sunfish	2.4 - 10.5	68	16
BFSCE	ACOE Channel (east)	12/16/2005	Green sunfish	16.1	52	1
BFMCE	ACOE Channel (east)	12/16/2005	Shiner sp.	NR	75	24
FFCE	ACOE Channel (east)	12/16/2005	Mosquitofish	NR	16	47
GSWCE	ACOE Channel (east)	12/16/2005	Bluegill + Green sunfish	5.1 - 10.5	44	10
LMBWP	Retention Pond	12/16/2005	Largemouth bass	31	356	1
Fillet Sample Results [a]						
LMBFP	Retention Pond	12/16/2005	Largemouth bass	NR	NR	1
BMBFP	Retention Pond	12/16/2005	Bigmouth buffalo	NR	NR	1

Notes:
cm = centimeters
g = grams
NR = not reported

[a] Fillet fish concentrations are summarized herein but not included in the ecological risk assessment.

TABLE 12
Analytical Results for PCBs Detected in Whole Fish[a]
MISSOURI ELECTRIC WORKS

	Units (wet weight)	Minimum Concentration	Maximum Concentration	Mean Concentration	Frequency of Detection
Small Fish (<13 cm)					
Aroclor 1260	mg/kg	0.50	6.2	2.3	5 / 5
Lipids	%	1.5	5.4	3.3	5 / 5
Medium Fish (13 to 30 cm)					
Aroclor 1260	mg/kg	1.4	1.4	1.4	1 / 1
Lipids	%	4.1	4.1	4.1	1 / 1
Large Fish (>30 cm)					
Aroclor 1260	mg/kg	2.5	2.5	2.5	1 / 1
Lipids	%	0.79	0.79	0.79	1 / 1
Small and Medium Fish (<13 to 30 cm)					
Aroclor 1260	mg/kg	0.50	6.2	2.1	6 / 6
Lipids	%	1.5	5.4	3.5	6 / 6
Small, Medium, and Large Fish					
Aroclor 1260	mg/kg	0.50	6.2	2.2	7 / 7
Lipids	%	0.79	5.4	3.1	7 / 7

Notes:
cm = centimeters
mg/kg = milligrams per kilogram
PCBs = polychlorinated biphenyls

[a] Aroclors 1016, 1221, 1232, 1242, 1248, and 1254 were not detected in any whole body fish sample.

TABLE 13
Exposure Point Concentrations for Wildlife Receptors
MISSOURI ELECTRIC WORKS

Aroclor 1260 Concentration	Small Fish Concentration Csf (mg/kg)	Small and Medium Fish Concentration Csmf (mg/kg)	All Fish Concentration Caf (mg/kg)	Small Mammal Prey Concentration[a] Cm (mg/kg)
Maximum	6.2	6.2	6.2	5.3
Mean	2.3	2.1	2.2	0.98

Notes:
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
ND = not detected

[a] Estimated from Off-Property area soil concentrations and small mammal uptake factor (see text).

TABLE 14
Estimated Total Daily Intakes for Belted Kingfishers
MISSOURI ELECTRIC WORKS

Factor	Symbol	Value	Units	Basis
Food Ingestion Rate	IRf	0.50	g/g-day	Alexander 1977
Food Ingestion Rate	IRf	0.074	kg/day	calculated
Fraction of Diet as Fish	Psf	76%	unitless	USEPA 1993
Fraction of Diet as Small Mammal Prey	Pm	24%	unitless	USEPA 1993
Body Weight	BW	0.15	kg	USEPA 1993
Area Use Factor	AUF	1	unitless	assumption

Aroclor 1260 Concentration	Small Fish Concentration Csf (mg/kg)	Small Mammal Prey Cm (mg/kg)	Absorption Factor AF (unitless)	Total Daily Intake TDI (mg/kg-day)
Maximum	6.2	5.3	1	3.0
Mean	2.3	0.98	1	0.98

Notes:
TDI =[(Csf x Psf x IRf) + (Cm x Pm x IRf)] x AF x AUF x 1/BW

g/g-day = grams of food per gram of body weight per day
kg = kilograms
kg/day = kilograms per day
L/day = liters per day
mg/kg = milligrams per kilogram
mg/kg-day = milligrams of food per kilogram of body weight per day
mg/L = milligrams per liter

TABLE 15
Estimated Total Daily Intakes for Great Blue Herons
MISSOURI ELECTRIC WORKS

Factor	Symbol	Value	Units	Basis
Food Ingestion Rate	IRf	0.18	g/g-day	Kushlan 1978
Food Ingestion Rate	IRf	0.42	kg/day	calculated
Fraction of Diet as Fish	Psmf	100%	unitless	USEPA 1993
Body Weight	BW	2.3	kg	USEPA 1993
Area Use Factor	AUF	0.5	unitless	assumption

Aroclor 1260 Concentration	Small and Medium Fish Concentratio Csmf (mg/kg)	Absorption Factor AF (unitless)	Total Daily Intake TDI (mg/kg-day)
Maximum	6.2	1	0.56
Mean	2.1	1	0.19

Notes:
TDI =[(Csmf x Psmf x IRf)] x AF x AUF x 1/BW

g/g-day = grams of food per gram of body weight per day
kg = kilograms
kg/day = kilograms per day
L/day = liters per day
mg/kg = milligrams per kilogram
mg/kg-day = milligrams of food per kilogram of body weight per day
mg/L = milligrams per liter

TABLE 16
Estimated Total Daily Intakes for Red-tailed Hawks
MISSOURI ELECTRIC WORKS

Factor	Symbol	Value	Units	Basis
Food Ingestion Rate	IRp	0.089	g/g-day	USEPA 1993
Food Ingestion Rate	IRp	0.10	kg/day	calculated
Fraction of Diet as Small Mammal Prey	Pm	100%	unitless	USEPA 1993
Body Weight	BW	1.1	kg	USEPA 1993
Area Use Factor	AUF	0.50	unitless	assumption

Aroclor 1260 Concentration	Small Mammal Prey Concentration[a] Cm (mg/kg)	Absorption Factor AF (unitless)	Total Daily Intake TDI (mg/kg-day)
Maximum	5.3	1	0.23
Mean	0.98	1	0.044

Notes:
TDI =[(Cm x Pm x IRf)] x AF x AUF x 1/BW

g/g-day = grams of food per gram of body weight per day
kg = kilograms
kg/day = kilograms per day
mg/kg = milligrams per kilogram
mg/kg-day = milligrams of food per kilogram of body weight per day

[a] Estimated from Off-Property area soil concentrations and small mammal uptake factor (see text).

TABLE 17
Estimated Total Daily Intakes for Mink
MISSOURI ELECTRIC WORKS

Factor	Symbol	Value	Units	Basis
Food Ingestion Rate	IRf	0.14	g/g-day	USEPA 1993
Food Ingestion Rate	IRf	0.12	kg/day	calculated
Fraction of Diet as Fish	Paf	30%	unitless	USEPA 1993
Fraction of Diet as Small Mammal Prey	Pm	70%	unitless	USEPA 1993
Body Weight	BW	0.85	kg	Mitchell 1961
Area Use Factor	AUF	0.5	unitless	assumption

Aroclor 1260 Concentration	All Fish Concentration Caf (mg/kg)	Small Mammal Prey Concentration[a] Cm (mg/kg)	Absorption Factor AF (unitless)	Total Daily Intake TDI (mg/kg-day)
Maximum	6.2	5.3	1	0.39
Mean	2.2	0.98	1	0.094

Notes:
TDI =[(Caf x Paf x IRf) + (Cm x Pm x IRf)] x AF x AUF x 1/BW

g/g-day = grams of food per gram of body weight per day
kg = kilograms
kg/day = kilograms per day
L/day = liters per day
mg/kg = milligrams per kilogram
mg/kg-day = milligrams of food per kilogram of body weight per day
mg/L = milligrams per liter

[a] Estimated from Off-Property area soil concentrations and small mammal uptake factor (see text).

TABLE 18
Toxicity Reference Values for Wildlife Receptors
MISSOURI ELECTRIC WORKS

	Test Species Dose (mg/kg-day)	Source	TRV (mg/kg-day)
Birds			
NOAEL	1.8	Dahlgren et al. 1972	1.8
LOAEL	7.1	Dahlgren et al. 1972	7.1
Geometric mean			3.6
Mammals			
NOAEL	0.14	Aulerich and Ringer 1977	0.14
LOAEL	0.69	Aulerich and Ringer 1977	0.69
Geometric mean			0.31

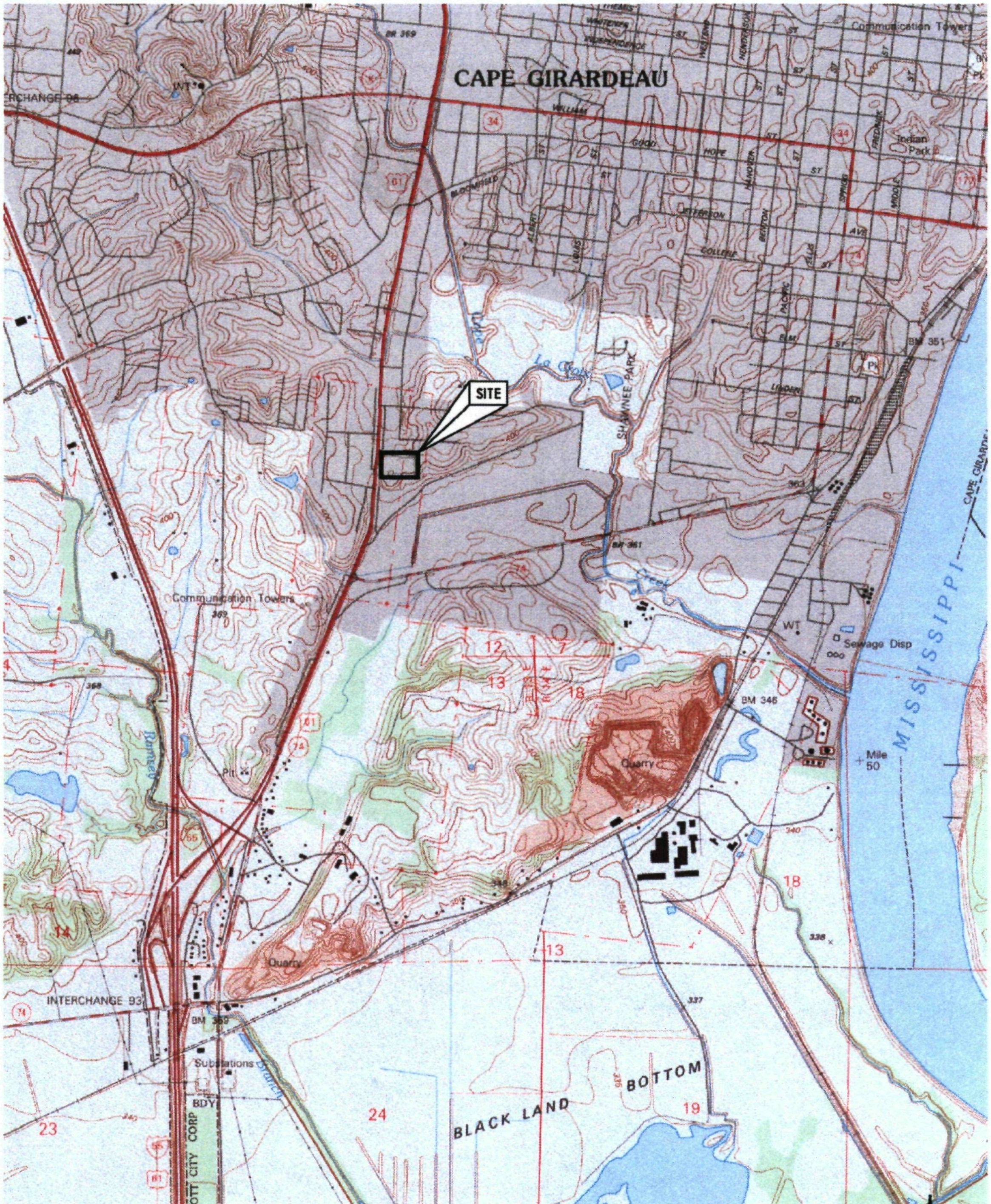
Notes:
kg = kilogram
LOAEL = lowest observed adverse effect level
mg/kg-day = milligrams of COPEC per kilogram of body weight per day
NOAEL = no observed adverse effect level

TABLE 19
Summary of Hazard Quotients for Wildlife Receptors
MISSOURI ELECTRIC WORKS

	Belted Kingfisher HQ	Great Blue Heron HQ	Red-tailed Hawk HQ	Mink HQ
Maximum	0.8	0.2	0.1	1
Mean	0.3	0.1	0.01	0.3

Notes:
HQ (hazard quotient) = Total Daily Intake / Toxicity Reference Value

FIGURES

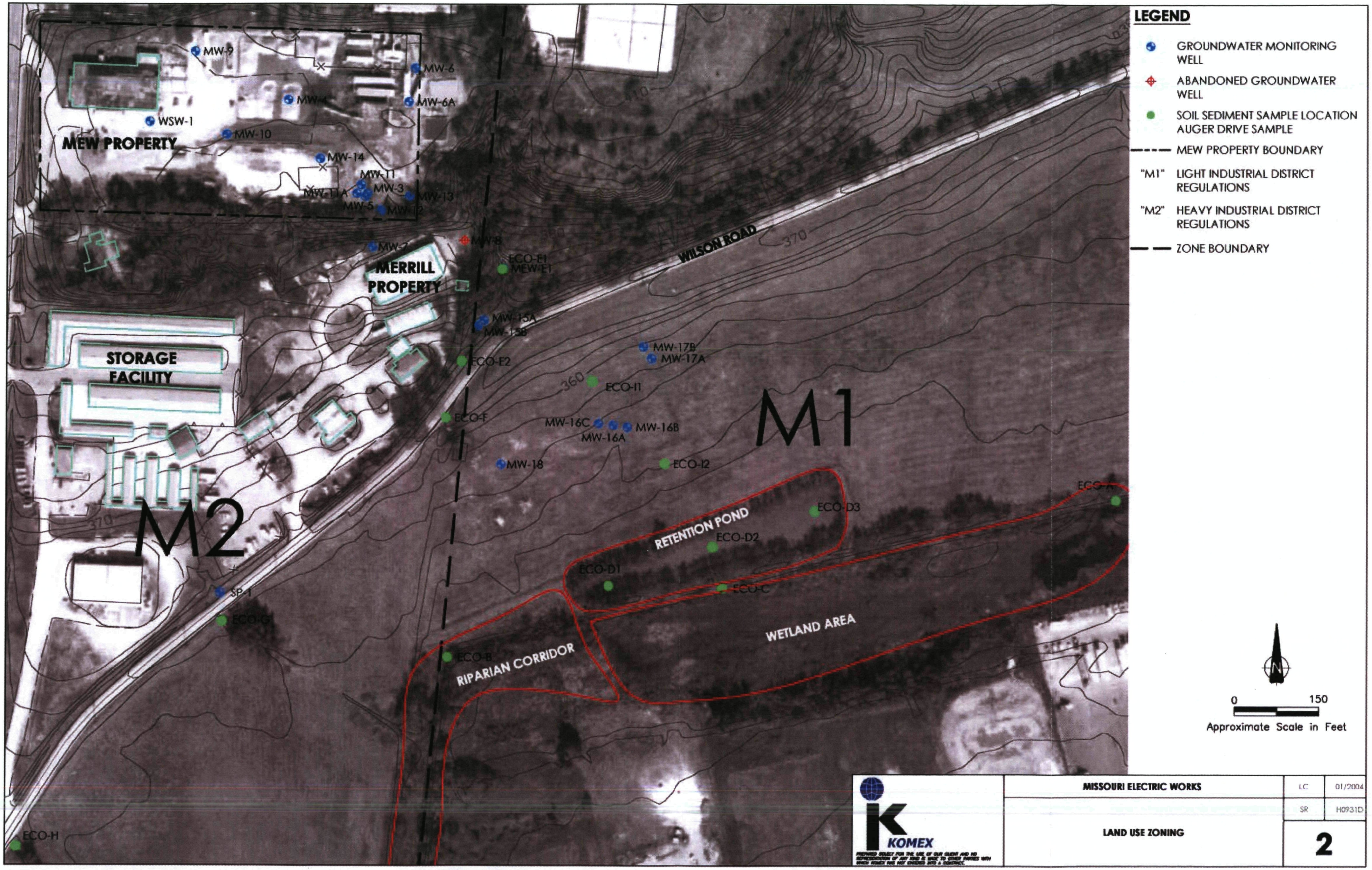


NOTES
1) BASE MAP FROM USGS 7.5 MINUTE CAPE GIRARDEAU QUADRANGLE (1965, REVISED 1993).

2) ALL LOCATIONS ARE APPROXIMATE.

0 0.5
Approximate Scale in Miles

KOMEX	MISSOURI ELECTRIC WORKS	LC	01/2004
		SR	H0931D
	SITE LOCATION MAP	1	



LEGEND
GROUNDWATER MONITORING WELL
ABANDONED GROUNDWATER WELL
SOIL SEDIMENT SAMPLE LOCATION AUGER DRIVE SAMPLE
MEW PROPERTY BOUNDARY
"M1" LIGHT INDUSTRIAL DISTRICT REGULATIONS
"M2" HEAVY INDUSTRIAL DISTRICT REGULATIONS
ZONE BOUNDARY
MEW PROPERTY
MERRILL PROPERTY
STORAGE FACILITY
WILSON ROAD
M1
M2
RETENTION POND
WETLAND AREA
RIPARIAN CORRIDOR
MW-9
MW-6
MW-4
MW-6A
WSW-1
MW-10
MW-14
MW-11
MW-3
MW-11A
MW-13
MW-5
MW-12
MW-7
MW-8
ECO-E1
MEW-E1
MW-15A
MW-15B
MW-17B
MW-17A
ECO-E2
ECO-I1
ECO-F
MW-16C
MW-16B
MW-16A
MW-18
ECO-I2
ECO-A
ECO-D3
ECO-D2
ECO-D1
ECO-C
SP-1
ECO-G
ECO-B
ECO-H
370
360
0
150
Approximate Scale in Feet
KOMEX
MISSOURI ELECTRIC WORKS
LAND USE ZONING
LC
01/2004
SR
H0931D
2

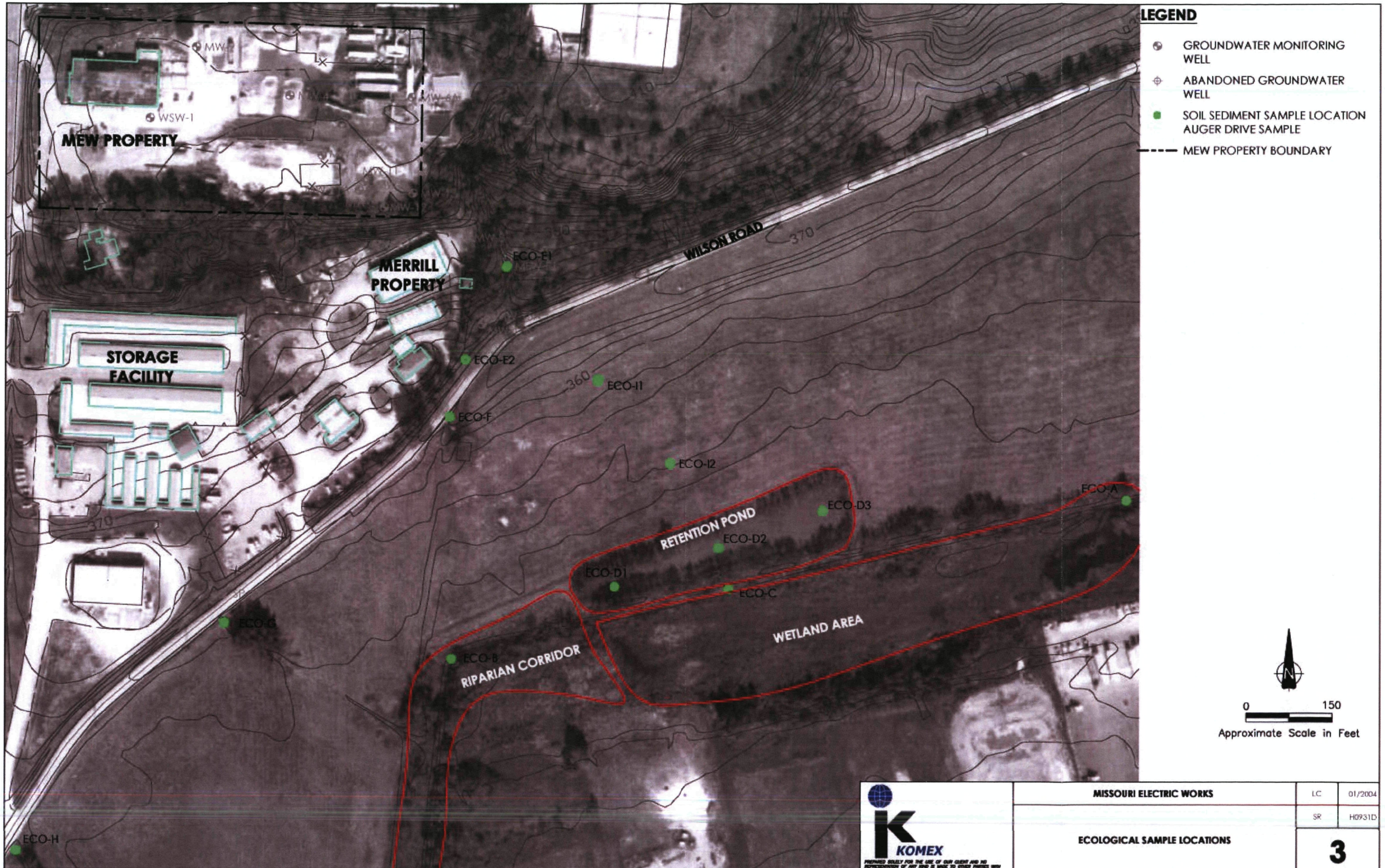
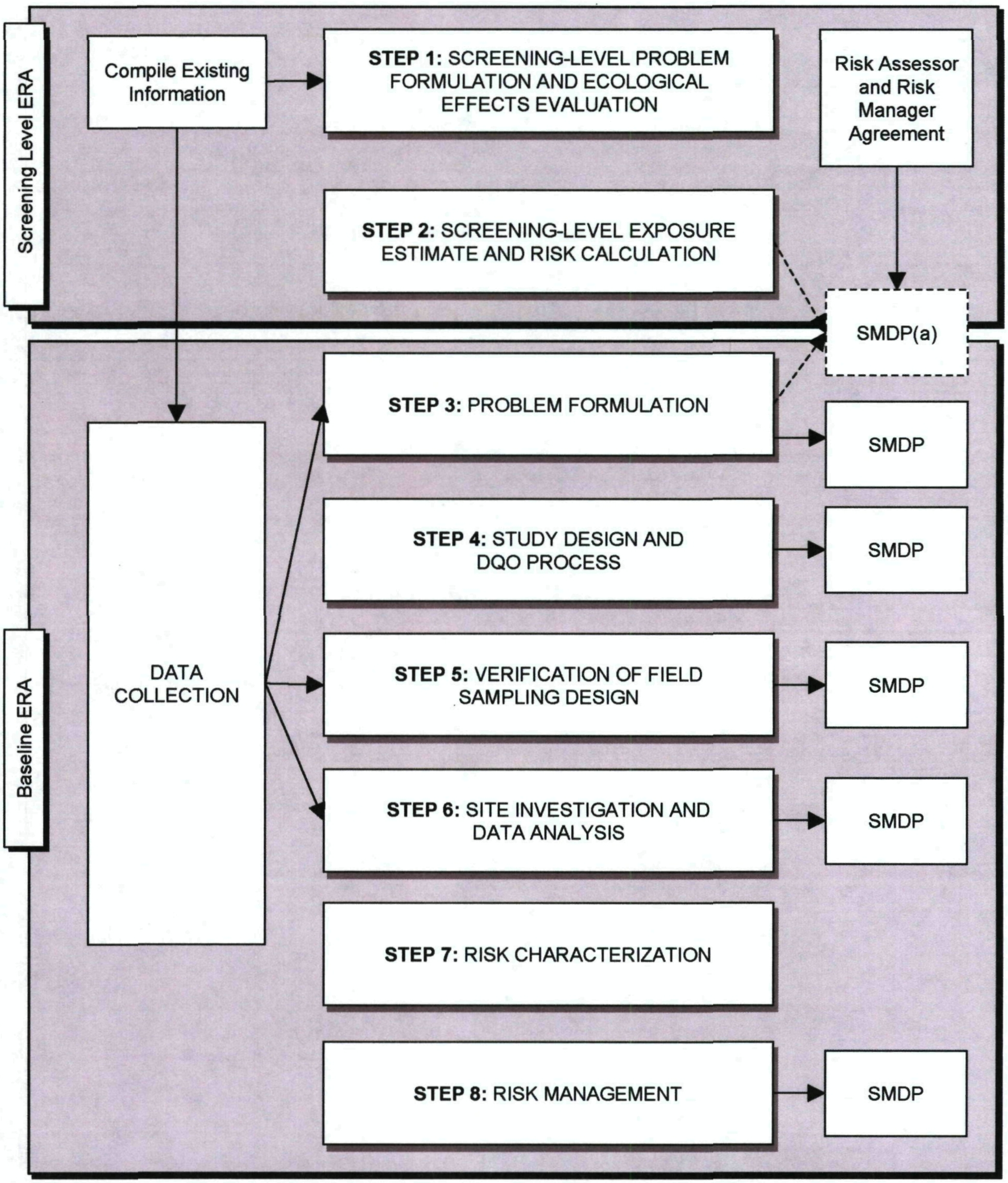

LEGEND
GROUNDWATER MONITORING WELL
ABANDONED GROUNDWATER WELL
SOIL SEDIMENT SAMPLE LOCATION AUGER DRIVE SAMPLE
MEW PROPERTY BOUNDARY
MEW PROPERTY
WSW-1
MERRILL PROPERTY
STORAGE FACILITY
WILSON ROAD
370
360
ECO-E1
ECO-E2
ECO-I1
ECO-F
ECO-I2
ECO-A
ECO-D3
RETENTION POND
ECO-D2
ECO-D1
ECO-C
WETLAND AREA
ECO-G
ECO-B
RIPARIAN CORRIDOR
ECO-H
0
150
Approximate Scale in Feet
KOMEX
MISSOURI ELECTRIC WORKS
LC
01/2004
SR
H0931D
ECOLOGICAL SAMPLE LOCATIONS
3

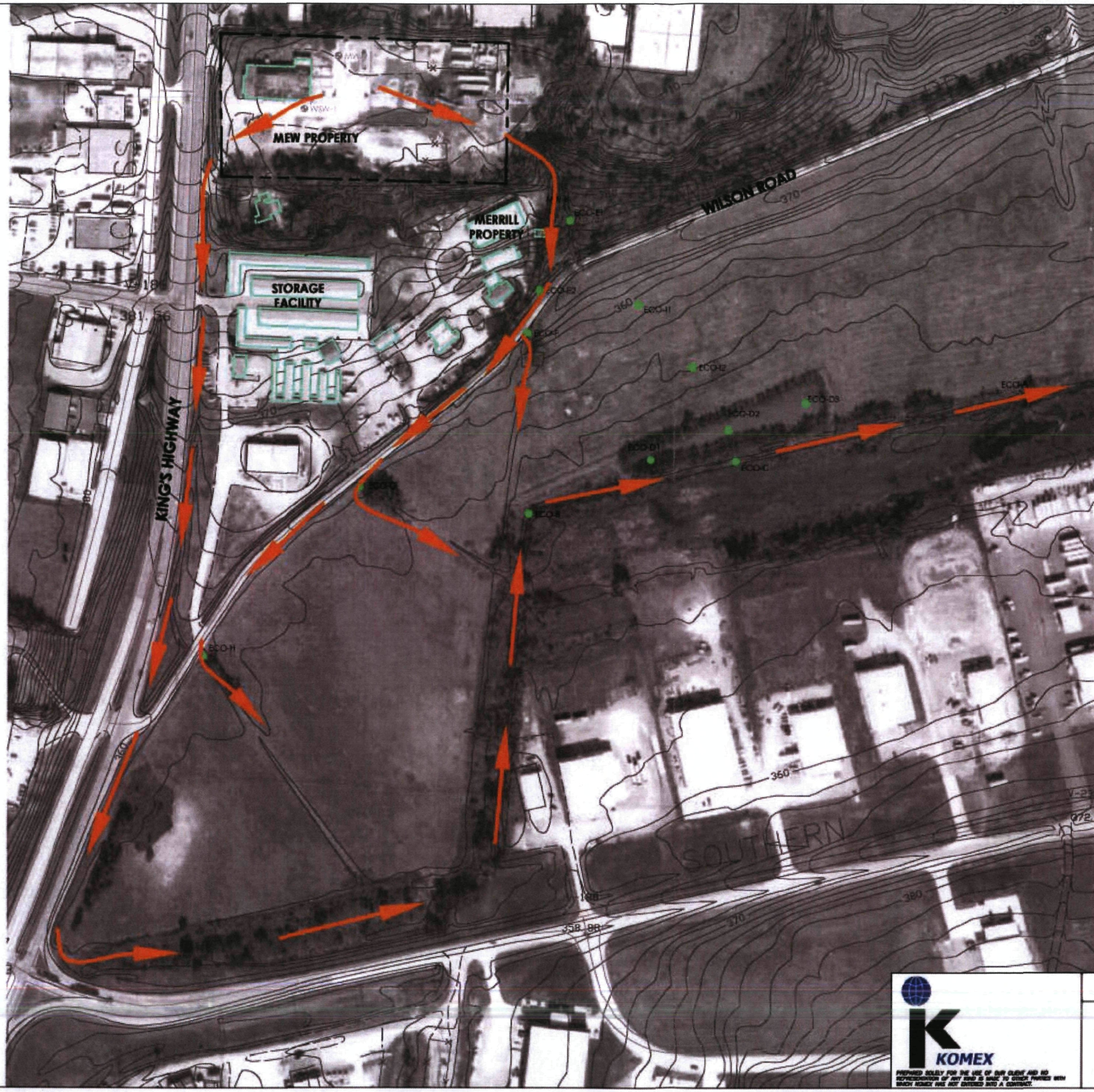
Figure 4

USEPA 8-Step Ecological Risk Assessment Process



Notes:

(a) SDMP occurs EITHER after Step 2 or after Step 3a.
ERA Ecological Risk Assessment.
SMDP Scientific Management Decision Point.
Source: Adapted from USEPA, 2000a.



LEGEND

- GROUNDWATER MONITORING WELL
- ABANDONED GROUNDWATER WELL
- SOIL SEDIMENT SAMPLE LOCATION AUGER DRIVE SAMPLE
- MEW PROPERTY BOUNDARY
- SURFACE WATER FLOW PATHWAY

N

0 250
Approximate Scale in Feet

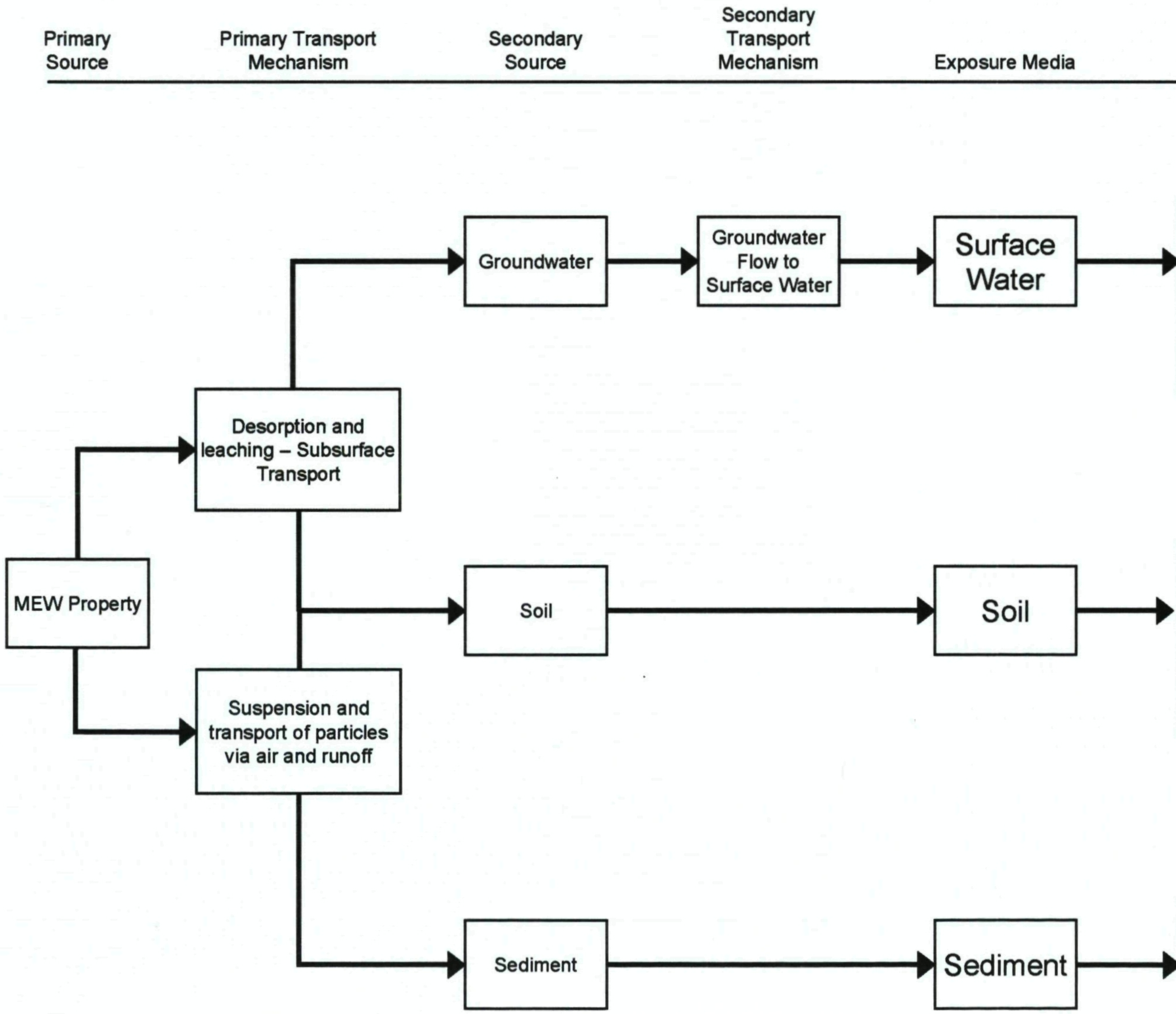
KOMEX	MISSOURI ELECTRIC WORKS	LC	01/2004
		SR	H0931D
	SURFACE WATER FLOW MAP	5	

ENVIRON

Figure 6

Conceptual Site Model

Missouri Electric Works



Surface Water

	Aquatic Biota	Piscivores	Terrestrial Wildlife
Ingestion	●	●	●
Respiration	●		
Contact	●	●	●
Food Web	●	●	●

Soil

	Aquatic Biota	Piscivores	Terrestrial Wildlife
Ingestion			●
Respiration			
Contact			●
Food Web			●

Sediment

	Aquatic Biota	Piscivores	Terrestrial Wildlife
Ingestion	●		
Respiration			
Contact	●		
Food Web	●		

Appendix A
Complete Analytical Results for Soil and Sediment

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SEDIMENT SAMPLE LOCATIONS														
LOCATION	A	B	C	D1	D1	D1	D2	D2	D2	D3	D3	D3	G	H	H (Duplicate)
DEPTH (Feet)	0	0	0	1	2	3	1	2	3	1	2	3	0	0	0
SAMPLE MATRIX	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
CHEMICAL NAME	08/15/03	08/12/03	08/14/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/14/03	08/15/03	08/15/03
1,1,1-Trichloroethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,1,2,2-Tetrachloroethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,1,2-Trichloroethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,1-Dichloroethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,1-Dichloroethylene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,2,4-Trichlorobenzene	< 7.2	< 5.9	< 7.3	< 850	< 4200	< 4000	< 9.1	< 9.1	< 8.3	< 4200	< 4300	< 4800	< 4.0	< 5.5	< 5.2
1,2-Benzphenanthracene	< 2900	< 4300	**700 J**	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
1,2-Dibromo-3-Chloropropane (DBCP)	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,2-Dibromoethane (EDB)	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,2-Dichlorobenzene	< 7.2	< 5.9	< 7.3	< 850	< 4200	< 4000	< 9.1	< 9.1	< 8.3	< 4200	< 4300	< 4800	< 4.0	< 5.5	< 5.2
1,2-Dichloroethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,2-Dichloropropane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
1,4-Dichlorobenzene	< 7.2	< 5.9	< 7.3	< 850	< 4200	< 4000	< 9.1	< 9.1	< 8.3	< 4200	< 4300	< 4800	< 4.0	< 5.5	< 5.2
2- Methylphenol (o-Cresol)	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2,4,5-Trichlorophenol	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
2,4,6-Trichlorophenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2,4-Dichlorophenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2,4-Dimethylphenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2,4-Dinitrophenol	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
2,4-Dinitrotoluene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2,6-Dinitrotoluene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2-Butanone (MEK)	**110**	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
2-Chloronaphthalene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2-Chlorophenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2-Methylnaphthalene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
2-Nitroaniline	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
2-Nitrophenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
3,3`-Dichlorobenzidine	< 5900	< 8800	< 5400	< 1700	< 8500	< 8100	< 7200	< 6300	< 6800	< 8500	< 8700	< 9700	< 4000	< 860	< 870
3,5,5-Trimethyl-2-Cyclohexene-1-One	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
3-Nitroaniline	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
4- Methylphenol (p-Cresol)	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
4,6-Dinitro-2-Methyl Phenol	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
4-Bromophenyl Phenyl Ether	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
4-Chloro-3-methylphenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
4-Chlorophenyl Phenyl Ether	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
4-Methyl-2-Pentanone (MIBK)	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
4-Nitrophenol	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
Acenaphthene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Acenaphthylene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Acetone	**78**	**83**	**90**	**250**	**170**	**190**	< 36	**110**	**95**	**180**	**230**	**300**	**49**	< 22	**23**

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SEDIMENT SAMPLE LOCATIONS														
LOCATION	A	B	C	D1	D1	D1	D2	D2	D2	D3	D3	D3	G	H	H (Duplicate)
DEPTH (Feet)	0	0	0	1	2	3	1	2	3	1	2	3	0	0	0
SAMPLE MATRIX	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
CHEMICAL NAME	08/15/03	08/12/03	08/14/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/14/03	08/15/03	08/15/03
Anthracene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Aroclor-1016	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1221	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1232	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1242	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1248	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1254	< 59	< 88	< 54	< 86	< 85	< 80	< 72	< 62	< 67	< 85	< 87	< 97	< 40	< 43	< 43
Aroclor-1260	**260**	**950**	**180**	**260**	**150**	**200**	**170**	**160**	**150**	**140**	**120**	**130**	**1100**	**66**	**25 J**
Benzene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**1.8 J**	< 5.5	< 5.2
Benzo(a)anthracene	< 2900	< 4300	**620 J**	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzo(a)pyrene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzo(b)fluoranthene	< 2900	< 4300	**960 J**	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzo(g,h,i)perylene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzo(k)fluoranthene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Benzyl Butyl Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
bis(2-Chloroethoxy)Methane	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
bis(2-chloroethyl)Ether	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
bis(2-chloroisopropyl)Ether	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
bis(2-ehtylhexyl)Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Bromodichloromethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Bromomethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Carbazole	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Carbon Disulfide	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Carbon Tetrachloride	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
CFC-11	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
CFC-12	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Chlorinated Fluorocarbon (Freon 113)	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Chlorobenzene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Chlorodibromomethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Chloroethane	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Chloroform	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Chloromethane	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
cis-1,2-Dichloroethene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
cis-1,3-Dichloropropene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Cumene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Cyclohexane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Dibenzo(a,h)Anthracene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Dibenzofuran	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Dichloromethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Diethyl Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SEDIMENT SAMPLE LOCATIONS														
LOCATION	A	B	C	D1	D1	D1	D2	D2	D2	D3	D3	D3	G	H	H (Duplicate)
DEPTH (Feet)	0	0	0	1	2	3	1	2	3	1	2	3	0	0	0
SAMPLE MATRIX	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
CHEMICAL NAME	08/15/03	08/12/03	08/14/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/15/03	08/14/03	08/15/03	08/15/03
Dimethyl Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Di-n-Butyl-Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Di-N-Octyl Phthalate	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Ethylbenzen	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
Ethylbenzene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**2.7 J**	< 5.5	< 5.2
Fluoranthene	< 2900	< 4300	**780 J**	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Fluorene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Hexachloro-1,3-Butadiene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Hexachlorobenzene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Hexachlorocyclopentadiene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Hexachloroethane	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Indeno(1,2,3-cd)pyrene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
m,p-Xylene	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	**10**	< 11	< 10
m-dichlorobenzene	< 7.2	< 5.9	< 7.3	< 850	< 4200	< 4000	< 9.1	< 9.1	< 8.3	< 4200	< 4300	< 4800	< 4.0	< 5.5	< 5.2
Methyl Acetate	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Methyl n-Butyl Ketone	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10
Methyl Tert-Butyl Ether	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Methylcylohexane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**17**	**2.0 J**	**1.9 J**
Naphthalene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Nitrobenzene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
n-Nitroso-Di-n-propylamine	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
n-Nitrosodiphenylamine	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
o-Xylene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	**3.5 J**	< 5.5	< 5.2
p-Chloroaniline	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Pentachlorophenol	< 15000	< 22000	< 14000	< 4400	< 22000	< 21000	< 18000	< 16000	< 17000	< 22000	< 22000	< 25000	< 10000	< 2200	< 2200
Percent Moisture	**43.4**	**62**	**38.2**	**61.4**	**60.8**	**58.7**	**53.9**	**46.7**	**50.5**	**60.7**	**61.7**	**65.5**	**17.2**	**22.2**	**23.1**
Phenanthrene	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Phenol	< 2900	< 4300	< 2700	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Pyrene	< 2900	< 4300	**930 J**	< 850	< 4200	< 4000	< 3600	< 3100	< 3300	< 4200	< 4300	< 4800	< 2000	< 420	< 430
Styrene (Monomer)	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Tetrachloroethene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Toluene	**2.2 J**	**1.8 J**	**21**	< 18	< 11	< 14	< 9.1	**3.8 J**	< 8.3	< 12	< 13	**4.4 J**	**15**	**1.8 J**	**1.6 J**
trans-1,2-Dichloroethene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
trans-1,3-Dichloropropene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Tribomomethane	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Trichloroethylene	< 7.2	< 5.9	< 7.3	< 18	< 11	< 14	< 9.1	< 9.1	< 8.3	< 12	< 13	< 14	< 4.0	< 5.5	< 5.2
Vinyl Chloride	< 14	< 12	< 15	< 35	< 23	< 28	< 18	< 18	< 17	< 24	< 26	< 29	< 8.0	< 11	< 10

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SOIL SAMPLE LOCATIONS																			
LOCATION	E2	E2	E2	F	F	F	G	G	G	H	H	H	I1	I1	I1	I2	I2	I2	I2 (Duplicate)	I2 (Duplicate)
DEPTH (Feet)	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3
SAMPLE MATRIX	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
CHEMICAL NAME	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/14/03	08/14/03	08/14/03	08/15/03	08/15/03	08/15/03	08/12/03	08/13/03	08/13/03	08/12/03	08/13/03	08/13/03	08/14/03	08/14/03
1,1,1-Trichloroethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,1,2,2-Tetrachloroethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,1,2-Trichloroethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,1-Dichloroethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,1-Dichloroethylene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,2,4-Trichlorobenzene	< 5.4	< 5.2	< 5.1	< 400	< 410	< 410	< 5.7	< 4.7	< 400	< 6.2	< 420	< 410	< 6.3	< 410	< 430	< 6.0	< 5.4	< 5.1	< 420	< 410
1,2-Benzphenanthracene	< 430	< 430	< 410	< 400	< 410	< 410	**280 J**	< 390	< 400	**170 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
1,2-Dibromo-3-Chloropropane (DBCP)	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,2-Dibromoethane (EDB)	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,2-Dichlorobenzene	< 5.4	< 5.2	< 5.1	< 400	< 410	< 410	< 5.7	< 4.7	< 400	< 6.2	< 420	< 410	< 6.3	< 410	< 430	< 6.0	< 5.4	< 5.1	< 420	< 410
1,2-Dichloroethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,2-Dichloropropane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
1,4-Dichlorobenzene	< 5.4	< 5.2	< 5.1	< 400	< 410	< 410	< 5.7	< 4.7	< 400	< 6.2	< 420	< 410	< 6.3	< 410	< 430	< 6.0	< 5.4	< 5.1	< 420	< 410
2- Methylphenol (o-Cresol)	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2,4,5-Trichlorophenol	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
2,4,6-Trichlorophenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2,4-Dichlorophenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2,4-Dimethylphenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2,4-Dinitrophenol	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
2,4-Dinitrotoluene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2,6-Dinitrotoluene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2-Butanone (MEK)	< 11	< 10	< 10	**17**	**32**	< 8.5	**34**	< 9.4	< 8.0	< 12	< 8.7	< 8.7	**29**	< 8.2	< 9.0	< 12	**22**	< 10	< 9.6	**18**
2-Chloronaphthalene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2-Chlorophenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2-Methylnaphthalene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
2-Nitroaniline	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
2-Nitrophenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
3,3'-Dichlorobenzidine	< 880	< 870	< 840	< 800	< 830	< 840	< 940	< 800	< 820	< 960	< 850	< 830	< 770	< 840	< 880	< 750	< 850	< 850	< 850	< 830
3,5,5-Trimethyl-2-Cyclohexene-1-One	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
3-Nitroaniline	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
4- Methylphenol (p-Cresol)	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
4,6-Dinitro-2-Methyl Phenol	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
4-Bromophenyl Phenyl Ether	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
4-Chloro-3-methylphenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
4-Chlorophenyl Phenyl Ether	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
4-Methyl-2-Pentanone (MIBK)	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
4-Nitrophenol	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
Acenaphthene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Acenaphthylene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Acetone	**95**	**100**	< 20	**220**	**210**	**150**	**150**	**39**	**37**	< 25	< 17	< 17	**370**	< 16	**95**	**190**	**200**	**67**	**73**	**150**
Anthracene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Aroclor-1016	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1221	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1232	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1242	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1248	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1254	< 44	< 43	< 42	< 40	< 42	< 42	< 470	< 40	< 41	< 48	< 42	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41
Aroclor-1260	**1800**	**4000**	**610**	**1800**	**36 J**	< 42	**4400**	**720**	**1000**	**120**	**30 J**	< 41	< 38	< 42	< 44	< 37	< 42	< 42	< 42	< 41

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SOIL SAMPLE LOCATIONS																			
LOCATION	E2	E2	E2	F	F	F	G	G	G	H	H	H	I1	I1	I1	I2	I2	I2	I2 (Duplicate)	I2 (Duplicate)
DEPTH (Feet)	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3
SAMPLE MATRIX	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
CHEMICAL NAME	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/14/03	08/14/03	08/14/03	08/15/03	08/15/03	08/15/03	08/12/03	08/13/03	08/13/03	08/12/03	08/13/03	08/13/03	08/14/03	08/14/03
Benzene	**4.1 J**	**1.3 J**	< 5.1	**2.1 J**	< 4.7	< 4.3	**2.9 J**	**2.1 J**	< 4.0	**2.2 J**	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Benzo(a)anthracene	< 430	< 430	< 410	< 400	< 410	< 410	**170 J**	< 390	< 400	**120 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(a)pyrene	< 430	< 430	< 410	< 400	< 410	< 410	**300 J**	< 390	< 400	**160 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(b)fluoranthene	< 430	< 430	< 410	< 400	< 410	< 410	**380 J**	< 390	< 400	**230 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(g,h,i)perylene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzo(k)fluoranthene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Benzyl Butyl Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
bis(2-Chloroethoxy)Methane	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
bis(2-chloroethyl)Ether	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
bis(2-chloroisopropyl)Ether	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
bis(2-ehtylhexyl)Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Bromodichloromethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Bromomethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Carbazole	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Carbon Disulfide	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
Carbon Tetrachloride	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
CFC-11	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
CFC-12	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
Chlorinated Fluorocarbon (Freon 113)	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
Chlorobenzene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Chlorodibromomethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Chloroethane	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
Chloroform	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Chloromethane	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
cis-1,2-Dichloroethene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
cis-1,3-Dichloropropene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Cumene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Cyclohexane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Dibenzo(a,h)Anthracene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Dibenzofuran	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Dichloromethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Diethyl Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Dimethyl Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Di-n-Butyl-Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Di-N-Octyl Phthalate	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Ethylbenzen	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
Ethylbenzene	< 5.4	< 5.2	< 5.1	**1.5 J**	< 4.7	< 4.3	**4.4 J**	**4.4 J**	**0.85 J**	**4.4 J**	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Fluoranthene	< 430	< 430	< 410	< 400	< 410	< 410	**520**	**52 J**	< 400	**290 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Fluorene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Hexachloro-1,3-Butadiene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Hexachlorobenzene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Hexachlorocyclopentadiene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Hexachloroethane	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Indeno(1,2,3-cd)pyrene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
m,p-Xylene	< 11	< 10	< 10	**5.6 J**	< 9.4	< 8.5	**17**	**18**	**3.2 J**	**16**	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2
m-dichlorobenzene	< 5.4	< 5.2	< 5.1	< 400	< 410	< 410	< 5.7	< 4.7	< 400	< 6.2	< 420	< 410	< 6.3	< 410	< 430	< 6.0	< 5.4	< 5.1	< 420	< 410
Methyl Acetate	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Methyl n-Butyl Ketone	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2

APPENDIX A
COMPLETE ANALYTICAL RESULTS, SOILS AND SEDIMENT
MISSOURI ELECTRIC WORKS

	SOIL SAMPLE LOCATIONS																			
LOCATION	E2	E2	E2	F	F	F	G	G	G	H	H	H	I1	I1	I1	I2	I2	I2	I2 (Duplicate)	I2 (Duplicate)
DEPTH (Feet)	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3	5	0	3
SAMPLE MATRIX	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
CHEMICAL NAME	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/13/03	08/14/03	08/14/03	08/14/03	08/15/03	08/15/03	08/15/03	08/12/03	08/13/03	08/13/03	08/12/03	08/13/03	08/13/03	08/14/03	08/14/03
Methyl Tert-Butyl Ether	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Methylcylohexane	**6.7**	< 5.2	< 5.1	**10**	< 4.7	< 4.3	**30**	**19**	**5.6**	**27**	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Naphthalene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Nitrobenzene	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
n-Nitroso-Di-n-propylamine	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
n-Nitrosodiphenylamine	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
o-Xylene	< 5.4	< 5.2	< 5.1	**1.9 J**	< 4.7	< 4.3	**5.9**	**6.4**	**1.1 J**	**5.8 J**	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
p-Chloroaniline	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Pentachlorophenol	< 2200	< 2200	< 2100	< 2000	< 2100	< 2100	< 2400	< 2000	< 2100	< 2400	< 2200	< 2100	< 1900	< 2100	< 2200	< 1900	< 2200	< 2100	< 2100	< 2100
Percent Moisture	**24**	**23.3**	**20**	**16.7**	**19.8**	**20**	**28.7**	**15.8**	**18.2**	**30.6**	**21.5**	**18.9**	**12.6**	**20.1**	**23.9**	**10.7**	**21.6**	**21**	**20.8**	**19.1**
Phenanthrene	< 430	< 430	< 410	< 400	< 410	< 410	**230 J**	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Phenol	< 430	< 430	< 410	< 400	< 410	< 410	< 460	< 390	< 400	< 470	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Pyrene	< 430	< 430	< 410	< 400	< 410	< 410	**340 J**	< 390	< 400	**200 J**	< 420	< 410	< 380	< 410	< 430	< 370	< 420	< 420	< 420	< 410
Styrene (Monomer)	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Tetrachloroethene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Toluene	**2.2 J**	**2.1 J**	< 5.1	**7.8**	**1.2 J**	< 4.3	**22**	**19**	**4.5**	**20**	< 4.3	< 4.4	**1.4 J**	**1.0 J**	**1.6 J**	< 6.0	< 5.4	< 5.1	< 4.8	**1.1 J**
trans-1,2-Dichloroethene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
trans-1,3-Dichloropropene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Tribomomethane	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Trichloroethylene	< 5.4	< 5.2	< 5.1	< 4.9	< 4.7	< 4.3	< 5.7	< 4.7	< 4.0	< 6.2	< 4.3	< 4.4	< 6.3	< 4.1	< 4.5	< 6.0	< 5.4	< 5.1	< 4.8	< 4.6
Vinyl Chloride	< 11	< 10	< 10	< 9.7	< 9.4	< 8.5	< 11	< 9.4	< 8.0	< 12	< 8.7	< 8.7	< 13	< 8.2	< 9.0	< 12	< 11	< 10	< 9.6	< 9.2

Notes:
1- SE = sediment
2- SO = soil
3- < 7.2 = compound not detect at stated detection limit
4- J flag represents a value above laboratory detection limit, but below reporting limit.
5- ug/kg= micrograms per kilogram

Sample ID	Type of Sample	Methylene Chloride	Carbon disulfide	Bis(2-ethylhexl)phthalate
MEW-U-S-8-18-03	Equipment Blank	<5	<5	<10
MEW-U-SD-8-18-03	Equipment Blank	<5	<5	5.4J
MEW-U-W-8-18-03	Equipment Blank	<5	68	28
MEW-V-S-8-18-03	Field Blank	<5	<5	<10
MEW-V-SD-8-18-03	Field Blank	<5	<5	<10
MEW-V-W-8-18-03	Field Blank	<5	<5	<10
MEW-W-8-16-03	Trip Blank	11	<5	NA
MEW-Z-S-8-16-03	Trip Blank	19	<5	NA
MEW-X-SDP-8-16-03	Trip Blank	<5	<5	NA

NA - Not Analyzed

Appendix B
Komex Report of Findings: August 2003 Sampling

- **Preliminary Site Walkthrough**
- **Sampling Locations**
- **Sampling Protocol/Methodology**

(Revised as necessary by ENVIRON to cite figures and terminology in the June 2005 Ecological Risk Screening Evaluation)

INTRODUCTION

Presented in this document is a summary of the initial Site walkthrough that led to the August 2003 sampling, a description of the sampling locations and the rationale for each, and a summary of the findings.

PRELIMINARY SITE WALKTHROUGH (SUMMARY)

A preliminary Site walkthrough was conducted at the MEW Site and surrounding areas on June 9 and 10, 2003, to:

1. Determine the general ecology of the area;
2. Determine the possibility for PCB transport;
3. Identify possible exposure pathways; and
4. Identify appropriate sampling locations if needed.

Attention was specifically paid to ecologically sensitive areas such as wetlands. For this reason seepage areas were evaluated in addition to observing runoff patterns during a storm event that occurred during the walkthrough. Two areas of wetlands, and a riparian corridor were observed in the area southeast of the Site.

The area south of Wilson Road was identified as a wetland according to the ACOE delineation guidelines (ACOE, 1987, 1992). Previous reports have described this area as "marshy" (EarthTech, 1990). The ACOE channel was also examined and determined to be a wetland and riparian area using ACOE guidelines. Wetland determination forms have been completed for these areas and are included as **Appendix F**.

The following significant observations were made from the initial Site walkthrough:

- Saturated surface soil about 0.5 meter in diameter was observed in the eastern drainage ravine east of the Morrill property. This area was distinguished from other patches of wet soil by appearing saturated and muddy. The eastern drainage ravine outflow area on Wilson Road to the southeast of the property (Sample Area E2**, Figure 3)** falls along a potential fracture line which is part of the geophysical Line MEW 8 (MEW-8);
- The junction of the drainage ravine east of the Site and Wilson Road shows evidence of soil and gravel deposits that suggest cumulative deposition has occurred over time in the road area. A culvert outfall on the south side of Wilson Road was observed with vegetation that suggests longer-term saturation of that area (Sample Areas E1, F, G, H, **Figure 3**);
- The vegetation transect (from the Site to pond along the geophysical line MEW-8 [Komex, 2003c]) demonstrated evidence of long-term saturation as determined by the presence of dried algae mats on the surface, hydrophytic vegetation, and areas of saturation;
- An evidently man-made retention pond lies south of the property (Sampling Area D**, Figure 3**);
- Several culverts drain locations upland of Wilson Road, including the MEW Site (Sampling Areas F, G, H**, Figure 3**);
- A roadside ditch following Kingshighway (Highway 61) drains from the MEW Site;
- The series of culverts draining the South Expressway, Kingshighway (Highway 61), and

Moulton Road do not appear to be connected to the MEW Site; and

- The ACOE channel south of the retention pond contains an established wetland and shows evidence of nesting waterfowl and abundant wetland vegetation (Sampling Areas A,B,C, **Figure 3**).

The observed drainage patterns during the Site walk are shown as arrows on **Figure 5**. These drainage patterns were confirmed during a significant rainfall event on June 10, 2003. The drainage patterns indicated several areas of possible deposition of material from the MEW property (Sampling Areas E, F, G, and H on **Figure 3**).

The preliminary Site walkthough indicated a high potential for sediment to travel off Site into areas of concern, two of these areas of concern are wetlands.

SAMPLING LOCATIONS

Sampling locations were chosen based on initial concepts regarding transport mechanisms and exposure pathways. Sampling location areas A, B, and C are located in the ACOE engineered wetland channel/riparian area; Area D is located within the retention pond, Area E is located in the lower eastern drainage ravine; Areas F, G, and H are located at culvert deposits that drain areas upland of Wilson Road; and Area I is located in the Wet meadow. A surveyed sampling location map is provided on **Figure 3.** The characteristics of each location are described below based on field observations during the sampling event between August 11 and 18, 2003, and the Site walk on June 10, 2003 (Komex, 2003b). In addition, a map of the runoff flow from the storm event that occurred on June 10, 2003, is provided as **Figure 5**.

Area A

Area A was located within the ACOE channel and was intended to be a reference area due to its location significantly downstream of anticipated areas of concern. Area A was initially located upgradient of Areas B and C (Komex, 2003b). However, site evaluations conducted on August 11, 2003, by Komex and an Ameren representative revealed that the upgradient site did not exhibit sufficient ecological similarities to be a valid reference site. Site A was therefore relocated downgradient of Areas B and C to reflect similar habitat values to Areas B and C, and potentially far enough downstream to mitigate any potential contaminant influence from the Site.

Sampling location A was about 100 square feet within a riparian zone. Fallen branches and debris covered approximately 25% of the water surface. Sunlight was filtered for most of the day. Standing water was observed at this site during sampling.

Area B

Area B was in the ACOE channel downstream of the Wilson Road culvert **(Figure 3)**, this area may receive PCB-impacted runoff from overland flow across the wet meadow from culvert locations G and H along Wilson Road.

Sampling location B was about 100 square feet within a riparian zone. Fallen branches and debris covered about 30% of the water surface, and sunlight was filtered most of the day. Standing water was observed at this site during sampling.

Area C

Sampling Area C was located along the extension of the geophysical line MEW-8 (postulated fracture extension from the Site) through the retention pond in the ACOE channel (**Figure 3**), this area was, at the time of sampling, considered to have potentially received PCB-impacted material migrating through the fracture extended from the Site. However, modeling have shown that PCB was not likely to have been transported this far from the Site through the fracture, and the source of any PCB found at this site was likely to be from overland flow through the wet meadow (Komex, 2003h).

Sampling location C was about 100 square feet within a riparian zone. Fallen branches and debris covered about 20% of the water surface, and sunlight was filtered most of the day. Standing water was observed at this site during sampling.

Area D

Area D was located in the retention pond located along a fracture pattern that extended from the Site and was, at the time of sampling, considered to receive PCB-impacted material migrating through the fracture. However, as modeling has shown PCB is not likely to have been transported this far from the Site through the fracture, any PCB found at this site was more likely to have originated from surface flow (Komex, 2003h). The sampling of the retention pond was divided into three zones: D1 was located approximately 100 feet to the west of the center of the pond and MEW-8; D3 was located approximately 100 feet to the east of the center of the pond and MEW-8; and D2 was located in the center of the pond along MEW-8, as shown on **Figure 3**. D1 and D3 were intended to provide a comparison for potential impacts that were anticipated at D2.

Area E

Sampling Area E was located along a path of transport of sediment off Site through the eastern drainage ravine. A piezometer for sampling shallow groundwater was installed in Area E1, located within the eastern drainage ravine in the possible seepage area as shown on **Figure 3**. Sampling Area E2 is located in the outfall from this ravine on the north side of Wilson Road as shown on **Figure 3**. No standing water was observed at this site during sampling.

Area F

Sampling Area F was located west of the eastern drainage ravine outfall, on the south side of Wilson Road, along a route of material flow from the eastern drainage ravine as shown on **Figures 3** and **5**. Overflow from this pooled area may flow south into the wet meadow area. The sampling area was surrounded with willows and other hydrophytic vegetation. Standing water was observed at this site during sampling.

Area G

Sampling Area G was located west of Area F in the outfall from a culvert under Wilson Road that drains the ditch parallel to the north side of the road across from the Morrill Property (**Figure 3**). Although runoff is influenced by flow from the Morrill Property, Area G was located along the path of flow from Area F, and from the Site, as the MEW Site is located upgradient from the Morrill Property. Overflow from this pooled area may flow south into the wet meadow area. The sampling area was surrounded with willows and other hydrophytic vegetation. Standing water was observed at this site during sampling.

Area H

Sampling Area H was located west of Area G along Wilson Road in the outfall from a culvert draining the ditch parallel to the north side of the road across from the Air Gas Property (**Figure 3**). While the outfall waters are also influenced by flow from the Air Gas and Morrill Property, Area H was located along the path of overland flow from Area G, and from the Site, as the MEW Site is located upgradient from the Air Gas and Morrill Property. Overflow from this pooled area may flow south into the wet meadow area. The sampling area was surrounded with willows and other hydrophytic vegetation. Standing water was observed at this site during sampling.

Area I

Sampling Area I included two sampling sites along a fracture zone extending from the Site, along the geophysical line MEW-8 (Komex, 2003c). Area I1 was located at flag 740, 640 feet from the geophysical line MEW-8 origin, at the first signs of wetland vegetation. Area I2 was at flag 1020, 920 feet from the MEW-8 origin and located at approximately the last sighting of wetland vegetation. This area was considered the most likely area within the wet meadow to contain COEC from the MEW Site based on the presence of the fractured zone, but modeling has since demonstrated this not to be the case.

During the preliminary Site walk in June 2003, this area was designated as a wetland according to ACOE definitions (ACOE, 1987), the area has not been delineated. The area is described as "wet meadow" to distinguish it from the engineered wetland south of the retention pond. No standing water was observed at this site during sampling.

SAMPLING PROTOCOL/METHODOLOGY

Samples were collected for analysis of potential COEC and benthic macroinvertebrates during the week of August 11 and August 16, 2003, in accordance with the sampling plan (Komex, 2003b and 2003g). Chemical analyses were performed on surface water, shallow groundwater, soil, and sediment samples where applicable in sampling areas described above. Sample areas E and F were originally designated for water samples, however, no standing water was present at these sites during the sampling. Chemical analyses were performed by Analytical Environmental Services, Inc in accordance with the following methodologies: VOCs, U.S. EPA Method 8260B; semi-volatile organic compounds (SVOCs), U.S. EPA Method 8270C; and PCBs, U.S. EPA Method 8082. General water quality parameters (pH, conductivity, dissolved oxygen, temperature, salinity, and turbidity) were also taken at each site where standing water was present.

Benthic macroinvertebrate samples were collected from areas A, B, C, and D. Stuart Lynde Environmental Services and Consulting, Inc. analyzed the benthic macroinvertebrate samples for number and diversity. Percentage dominance and tolerance were also calculated for these samples. Benthic sweep and grab samples were collected from the sampling area locations as identified in the Komex Report (2003b) (with the exception of the change in location of sampling area A which was changed as described above). A change in sweep duration was also necessary to reduce the volume of vegetative material that was collected. The original sweep duration (45-minutes) was changed to a 15-minute composite sweep.

Appendix C
Flora and Fauna Observed by Komex

APPENDIX C
FAUNA, FLORA, AND VEGETATION OBSERVED
MISSOURI ELECTRIC WORKS

COMMON NAME	SCIENTIFIC NAME	ACOE CHANNEL	WET MEADOW	RETENTION POND MARGINS
Black-eyed Susan	*Rudbeckia hirta*		X	
Blue-eyed Grass	*Sisyrinchium spp.*		X	
Bog Berry	*Rubus lacinitus*		X	
Cattail	*Typha spp.*	X		
Cottonwood	*Populus spp.*	X		X
Duck Potato	*Sagitaria latifolia*	X		X
Duckweed	*Lemna spp.*	X		X
Elder	*Sambucus spp.*	X		X
Flat-topped Aster	*Aster spp.*		X	
Hackberry	*Celtis spp.*	X		X
Hibiscus	*Hibiscus moschuitos*	X	X	
Jewel Weed	*Impatiens capensis*	X		X
Marsh Marigold	*Ludwegia*	X		X
Marsh Milkweed	*Ascelepias incarnata*	X		
Nut Sedge	*carex, spp.*		X	
Onion	*Allium validata*		X	
Papyrus	*Cyperus spp.*		X	
Poison Ivy	*Rhus radicans*	X		X
Reed	*Juncus spp.*	X	X	X
Reed Canary Grass	*Phragmites austarlis*	X		X
Sedge	*Carex spp.*		X	
Sweet Clover	*Ozmoriza purpureum*		X	
Thistle	*Cirsilem spp*		X	
Tickseed	*Corispermum spp.*	X		
Vetch	*Vicia spp.*		X	
Willow	*Salix spp.*	X		X
Grass	*Phalaris spp.*	X		
Speedwell	*Veronica spp.*		X	
Egrets		X		
Frog		X		
Beaver		X		x
Cardinal (small birds in general)		X		
Hawk		X	x	
Opposum			X	
Mice			X	
Raccoon			X	x
Roosting Heron or Bittern				X
Gar				X
Carp				X

Notes:

1- spp. = species

Appendix D
Komex Review of Previous Off-Property Data

KOMEX REVIEW OF DATA FROM PREVIOUS REPORTS

Previous investigations of the Site indicate that PCB had been detected along the ditch on the south side of Wilson Road, the northern border of the wet meadow. Specifically, the Emergency Planning and Response Trip Report and Preliminary Soil Screening Data Summary (EP&R report) (U.S. EPA, 1986) and the Remedial Investigation Report, Missouri Electric Works Site (RI report) (EarthTech, 1990) contain information regarding PCB impacts found outside the boundaries of the Site.

The EP&R report (U.S.EPA, 1986) contains data from two sample points within the Diebold Property (the wet meadow) that indicated the presence of PCB at less than 1 part per million (ppm) and 1.3 ppm. The investigation also included analysis of samples taken within the southern portion of the east drainage ravine (the Hall St. Assoc property) that showed PCB concentrations up to 88 ppm, this area was included in the remediation. Finally, samples taken from the drainage ditch along Wilson Road to the southeast of the Site indicated no detection of PCB at that time. Samples were not taken in the ACOE channel nor the retention pond.

The RI report (EarthTech, 1990) contains more data on COC detected off Site. In Phase 1 of the RI, 25 sediment samples were taken in areas off Site to the west, south, and southeast of the Site. That sampling indicated that PCB was present in the drainage ditch running along Highway 61 in concentrations starting at 45 ppm near the Site to less than 1 ppm at the intersection of Highway 61 and Wilson Road. The RI sampling also indicated that PCB was present in the ditch running along Wilson Road with concentrations ranging from 8 ppm to less than 1 ppm. The highest PCB concentrations seen in the off Site areas were in the southern portion of the east drainage ravine where PCB concentrations ranged from 3 ppm to 696 ppm.

The RI report also indicated PCB was detected within the wet meadow. Analysis of Site and surrounding surface hydrology indicated that PCB-impacted sediment moved off Site through the ditch along Wilson Road and entered the "marshy area" (the wet meadow) about 1,000 feet from the Site boundary (EarthTech, 1990). Three sediment samples were taken near the boundary of the wet meadow. PCB was detected in concentrations ranging from 1 ppm to less than 5 ppm. Also reported in the RI is sampling from within the Wet meadow by U.S. EPA representatives. PCB was detected at a concentration of 1.3 ppm in one of the three samples.

No previous information has been reviewed that indicated historic presence of or sampling for COEC other than PCB in the areas surrounding the Site. Therefore, historic presence of COEC other than PCB is not known.

Appendix E
Komex Ecological Check Lists

Appendix E: Check Sheet for Ecological Description of Site

Setting -

1. **What are the land uses/facilities in the vicinity of the site?**

   North light & heavy Industrial

   South undeveloped / light industrial

   East undeveloped - then roads

   West Highway 101

   What directions do contaminant gradients follow?

   Surface water, sediment South/East of site, South through wet meadow

   Soil South East ravine to South off site towards wet meadow

   Ground water South

2. **What is the site's highest elevation?** 416' above sea level on Site

   What is its lowest elevation? 354' in wet meadow, & 351' in Creek

3. **Is the site readily accessible?** X Yes ___ No

   If No, explain:

4. **For each pair of descriptors, circle the one that best describes the site.**

   wooded/open billy/flat marshy/dry

   Other wooded (riparian) to South & in culvert drain areas.

5. **Does the site contain or drain into surface water?** X Yes ___ No

   If Yes, what type(s)?

   Pond or lake

   Location South/East of site - not receiving surface water but collecting rainwater and/or ground water

   Area

   Average Depth (or depth range) 7-9 feet.

Stream or river (including intermittent streams):

Location South, running to the east

Length 1 mile before converging with LaCroix Creek.

Average Width (or width range 3 - 20 feet to several hundred feet

Average Depth (or depth range 6 inches to 3 feet (summer)

Type(s) of bottom muck/organic sediments w/ detritus

Flow rate variable depending on season/rainfall

Estuary/embayment: NA

Location

Area

Average Depth (or depth range)

Type(s) of bottom

List any known parameters of site-associated surface water. (see data sheet, Appendix).

creek pond pH 7.3 Temperature 25-28°C Dissolved Oxygen 1.34 - 2.16 mg/L

Total Suspended Solids unknown

Total Organic Carbon unknown

Hardness unknown

Salinity 0.01% // conductivity: 0.28 - 0.38 mS/s.

Other (specify

List any known sediment parameters of site-associated bodies of surface water.

Sediment type(s) unknown

Grain Size unknown pH unknown Eh unknown pE unknown

Total Organic Carbon NA

Acid-Volatile Sulfides NA

Other (specify NA

(If more than one surface water body of each type, repeat information as needed.)

6. Does the site contain or drain into wetlands? X Yes ___ No

If Yes, what type(s) and size(s)?

1) Wet meadow, with [illegible] (depth 3-5 feet). About 60 acres (not surveyed). Formerly freshwater marsh.

2) Wetland / freshwater marsh with riparian woodland. About 20 acres (not surveyed)

List any known surface water and sediment parameters of site wetlands, as in #5, above.

Wet meadow dry at time of observation

pH: 7.37, Temp: 28.8°C, D.O. 2.16 mg/L, conductivity: 0.285 mS/s, salinity: 0.01%.

7. Describe sub-surface hydrology.

Overlying strata Silts, clays or sandy silt overlying sandstone (20 ft bgs)

Aquifer flow to southeast with slight downward gradient And Alluvial deposit w/ upward gradient to wet meadow

Depth to aquifer Saturated layer at 48" followed by dry layer below.

Location of groundwater discharge ACOE Channel(?)

Ecological Description

8. List and describe habitats that occur at the site.

Woodlands - Riparian

Grasslands/open fields → tilled, filled wetland.

Wetlands → wet meadow/freshwater marsh

Ponds → man-made impoundment

Streams → tributary to La Croix River

~~Estuaries~~ ______

~~Coastal zones~~ ______

Flood plains → channelized creek/upland drainage area.

Other natural areas mixed deciduous woodland to north of site.

List any known soil and sediment parameters for each terrestrial habitat. - not surveyed

Soil type(s ______

Grain Size ______ pH ______ Eh ______ pE ______

Total Organic Carbon ______

Total Phosphorus ______

Nitrogen forms ______

Other ______

9. Are any Federally or State listed endangered or threatened species known or suspected to occur on or near the site

___ Yes X No

If yes, list:

10. Does the site have any game species or species of interest for another reason? X Yes ___ No

If yes, list:

egrets observed onsite

ducks (mallards, woodducks) possible.

Known Ecological Effects

11. Does the site show any evidence of adverse ecological effects? X Yes ___ No

If yes, describe:

1) Benthic sampling indicates low species diversity and a dominance of high tolerance species.

2) Wet meadow has been tilled and filled.

12. Documentation attached:

X Site map(s)

X PA

___ SI

X Contaminant concentration data

X Species list(s) (non-exhaustive)

___ Preliminary Natural Resources Survey (PNRS)

X Other (specify Screening-level risk assessment report

Appendix F
Komex Wetland Determination Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: MEW Marshy area "X" south of Wilson Rd.	**Date:** 6-9-03.
Applicant/Owner: Diebold property for MEW Trust	**County:**
Investigator: H. Shepherd	**State:** Missouri
Do Normal Circumstances exist on the site? (Yes) No	**Community ID:**
Is the site significantly disturbed (Atypical Situation)? * Yes (No)	**Transect ID:**
Is the area a potential Problem Area? ** Yes (No) (If needed, explain on reverse.)	**Plot ID:** I-1

* Area has apparently been cultivated or mowed as regularly spaced tracks are evident.
** The area is not currently inundated.

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Blue-eye Grass (Sisyrinchium spp.)		OBL	9. Black-eyed Susan (Rudbeckia hirta)		FACU
2. Carex spp (Sedge)		OBL/FAC	10. Hibiscus moschutos		OBL
3. Sweet Clover (Trifolium spp)	white striped	FACW	11. Veronica spp.		OBL/FAC
4. Sweet Cicily (Ozmorhiza purpureum)		FAC	12. Thistle (cirsilem)		OBL
5. Bog berry (Rubus lacinitus)		FACW	13. Cyperus spp.		FACW
6. nut sedge (carex, spp)		OBL	14. Plattopaster (aster spp)		FAC
7. Reed (Juncus, spp)		OBL/FAC	15. Marsh Onion (Allium validuta)		OBL
8. beaked sedge? (carex spp)		OBL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 93%

Remarks:

HYDROLOGY

X Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- X Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: None (in.)

Depth to Free Water in Pit: ___ (in.)

Depth to Saturated Soil: 36"-40" (in.)
Aug. 18 boring

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- X Water Marks
- ___ Drift Lines
- X Sediment Deposits
- X Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- X Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- X Other (Explain in Remarks)

Remarks: Aerial photo recent taken in summer.
Soils: smell of reduced sulfur, wet grey (gley) layer seen at about 40". Algae deposits are abundant (on vegetation). Project personnel report standing water all winter.

SOILS 8

Map Unit Name
(Series and Phase): ______ Drainage Class: ______
Field Observations
Taxonomy (Subgroup): ______ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
- SEE Attached boring log -					

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ✓ Sulfidic Odor
- ✓ Aquic Moisture Regime
- ✓ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: low chrome soils with mottling

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes No (Circle)	(Circle)
Wetland Hydrology Present?	Yes No	Is this Sampling Point Within a Wetland? Yes No
Hydric Soils Present?	Yes No	

Remarks: The area is disturbed with apparently 2-5 feet of fill material, but hydric indicators are evident even in the fill-soils.

Approved by HQUSACE 2/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: MEW must // ACOE Channel	**Date:** 6-9-03
Applicant/Owner: Army Corps of Engineers Easement	**County:**
Investigator: H. Shepherd	**State:** Missouri
Do Normal Circumstances exist on the site? Yes (circled) No	**Community ID:**
Is the site significantly disturbed (Atypical Situation)? * Yes (circled) No	**Transect ID:**
Is the area a potential Problem Area? Yes No (circled)	**Plot ID:** ACOE Channel Site C
(If needed, explain on reverse.)	

*Channel has been widened or otherwised engineered in the last 10-years.

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Hibisus Moschetos		OBL	9. Typha, spp		OBL
2. Phalaris, spp		OBL	10.		
3. Phragmites, ~~spp~~ australis		FACW	11.		
4. Salix, spp (Willow)		OBL/FAC	12.		
5. lemna major ?		OBL	13.		
6. Wolfia spp.		OBL	14.		
7. Juncus, spp		OBL/FACW	15.		
8. Sagitaria latifolia		OBL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks:

HYDROLOGY

___ **Recorded Data (Describe in Remarks):**
 ___ Stream, Lake, or Tide Gauge
 ✓ Aerial Photographs
 ___ Other
___ **No Recorded Data Available**

Field Observations:

Depth of Surface Water: 6-12 (in.)

Depth to Free Water in Pit: — (in.)

Depth to Saturated Soil: — (in.)

Wetland Hydrology Indicators:

Primary Indicators:
 ✓ Inundated
 ✓ Saturated in Upper 12 Inches
 ___ Water Marks
 ___ Drift Lines
 ___ Sediment Deposits
 ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
 ___ Oxidized Root Channels in Upper 12 Inches
 ___ Water-Stained Leaves
 ___ Local Soil Survey Data
 ___ FAC-Neutral Test
 ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): ______________________ Drainage Class: __________

Field Observations

Taxonomy (Subgroup): ______________________ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ✓ Sulfidic Odor
- ___ Aquic Moisture Regime
- ✓ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 2/92

Appendix G

Fish Tissue Analytical Summary and Complete Analytical Results

APPENDIX G
Analytical Data Summary and Complete Analytical Results for Fish Collected in December 2005
MISSOURI ELECTRIC WORKS

Lab Sample Number	Field ID	Sampling Location	Matrix	Collection Date	Prep Method	Analytical Method	Constituent	Result & Qualifier	MDL	Units
867599-002	LMBWP	Pond	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	0.79		%
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	120 U	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	2500	120	µg/Kg
867599-002	LMBWP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	2500	120	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	4.63		%
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	180 U	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	2100	180	µg/Kg
867599-004	BFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	2100	180	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	2.00		%
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	480 U	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	6200	480	µg/Kg
867599-005	FFCW	Creek (west)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	6200	480	µg/Kg

Lab Sample Number	Field ID	Sampling Location	Matrix	Collection Date	Prep Method	Analytical Method	Constituent	Result & Qualifier	MDL	Units
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	4.12		%
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	120 U	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	1400	120	µg/Kg
867599-006	BFSCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	1400	120	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	5.38		%
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	27 U	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	500	27	µg/Kg
867599-007	BFMCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	500	27	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	3.16		%
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	120 U	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	1100	120	µg/Kg
867599-008	FFCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	1100	120	µg/Kg

APPENDIX G

Analytical Data Summary and Complete Analytical Results for Fish Collected in December 2005

MISSOURI ELECTRIC WORKS

Lab Sample Number	Field ID	Sampling Location	Matrix	Collection Date	Prep Method	Analytical Method	Constituent	Result & Qualifier	MDL	Units
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	1.49		%
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	70 U	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	1400	70	µg/Kg
867599-009	GSWCE	Creek (east)	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	1400	70	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	0.38		%
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	180 U	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	3100	180	µg/Kg
867599-001	LMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	3100	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	Pace Lipid	Pace Lipid	Percent Lipids	7.96		%
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1016	180 U	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1221	180 U	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1232	180 U	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1242	180 U	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1248	180 U	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1254	760	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Aroclor 1260	4200	180	µg/Kg
867599-003	BMBFP	Pond	Biota	12/16/2005	SW846 3540C	SW846 8082	Total PCBs	4900	180	µg/Kg

MDL - method detection limit
U - not detected
µg/Kg - micrograms per kilogram
% - percent